HISTORY AND INCIDENTS

— OF —

INDIAN CORN,

AND ITS CULTURE.

INCLUDING STATISTICAL, ANALYTICAL AND OTHER TABLES;

ALSO, ILLUSTRATIONS AND DIAGRAMS.

— BY —

WILLIAM D. EMERSON.

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PREFACE.

As the Maize Crop is one of the foundations of the prosperity of our Republic, the results of its culture have an interest for every citizen. The early history of Maize growth in the United States, is associated with one of the greatest events of modern times. Its statistics, herein tabled, may be studied in the light of the most celebrated movements of our own, and the European Governments, for ninety years that have passed. It is shown herein that Maize growth has intimate relations, not only with the acts of civil government, commerce, navigation, political economy, and the industrial and æsthetic arts, especially those that stimulate invention, and encourage experiment, but also with the sciences that have been built up through the long past, such as geography, astronomy, geometry, natural philosophy and natural history; and also with later-born chemistry, geology, botany, entomology and meteorology.

Although no amount of knowledge will supply the place of close observation and just reasoning in practical matters, yet, where the true brain and the well trained muscle go together, the more we know of the methods of others the better, because in overcoming new difficulties, we may find in the experience of others something that may save us from wading through costly experiments. Some prefer to walk in a prescribed path; others, to strike out paths of their own; but as in the Great Republic, corn is not gathered at the command of an Alcador, most men must be their own judges in choosing their respective modes of culture. One may fail in a method very successful in the hands of a next neighbor, not because the surrounding circumstances and external advantages are different, but simply because the two men are differently constituted. Hence it would appear that precise modes are less to be insisted on, than general principles variously illustrated.

The man who does not pursue Maize culture merely to get his money out of it, will often find a pleasure in learning how others, under great disadvantages, have struggled to bring the art gradually to perfection. He will hardly be content with knowing that the well to do prairie farmer of the West rides in a sulky that drags a heavy plow through the sod of centuries; that he rides on a corn planter to mark out and plant his fifteen or twenty acres per day; that he has a seat above his two-horse cultivator as it passes over the corn rows; that at the proper stage for cutting up, he drives through the corn rows his harvester that shocks as well as severs the stalks; that the machine corn husker makes the husking pin or glove needless, for saving his fingers, and that his own, or the neighborhood corn-sheller turns out naked cobs at the rate of five hundred bushels per day. If the far West, with its multiplied machinery, gathers splendid harvests from the rich new breadths of the soil, lifting human toil off from its feet, the East, with its improved implements and fertilizers wrings out of the depths of its renewed soil, its own rich harvests, gradually making human hands and feet far more effective.

As one of the objects in the preparation of this work has been to make it a book of reference for the leading facts and figures connected with Maize culture, the lists of Contents and Tables, and Index, have been very carefully prepared, so that persons desiring further information on the various topics connected with the main subject may have little trouble in looking for it.

The author has been mostly indebted to the Annual Reports of the Agricultural Division of the Patent Office, and of the more recent Agricultural Departments of the United States, and the State Agricultural Reports of Ohio; but he has also gathered from a great variety of other sources, including some of our oldest as well as our youngest public journals, and also from statements of farmers in different sections made to him personally. Great pains have been taken to have the facts and figures accurately stated.

The U. S. Agricultural Department estimates of the Maize product have been brought up in the tables to 1875. The crop has been abundant in the two succeeding years. That of 1877 has been estimated at thirteen hundred and ten millions of bushels; the number of swine for the same year 32,262,500. Kansas is credited with the heaviest yield per acre, forty-three and one-half bushels, New Hampshire being second. The Special Report for June, 1878, speaks of the condition of this crop as favorable in the South, less so in the North and West; a warm April inducing early planting, and consequent injury from the succeeding cool and wet season.

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Section I.

INDIAN CORN AND ITS CULTURE.

CHAPTER I.

PROXIMATE ELEMENTS.

The first great fact of the human system is the fire that keeps up its action. The atmosphere supports this, as well as all other fires, by supplying oxygen, one of its two chief constituents, nitrogen being the other, and the normal proportions of these being one of the former to four of the latter in volume. They are not, however, chemically combined, but only mechanically mixed. Nitrogen, a great conservative force in nature, fond of keeping itself distinct, acts as an effectual diluent of oxygen, so prone to combination, and so intensely energetic. As we inhale a volume of air, a quantity of venous blood in the lungs, rich in carbon, combines with part of the oxygen of this volume, and forms carbonic acid; while another part is taken up by the globules of the blood, now made a fit nutriment for the growing or wasted organs, and is driven through the arteries to every part of the system. The oxidation of the blood evolves heat, which is doubtless also produced by other processes within the system. The special heat-producing materials are furnished to other than carnivorous animals, in the starch, sugar, gum, oil, and dextrine ready formed in the grains, grasses, and other vegetable substances on which they feed.

The second great fact of the system is that repairs are constantly made necessary by the waste of the organs. The

more violent the action of these organs, the greater the waste. To keep them in condition requires nitrogen, combined with carbon, oxygen, and hydrogen, and also various mineral substances in small proportions. This nitrogen does not appear to be derived from the atmosphere in its simple form, but only when combined; and it is said to be ready for combination only when in presence of decomposing matter, animal or vegetable; one of its most important compounds being *ammonia*, the result of its union with hydrogen. It seems a most wonderful provision of nature, that this essential element, which is all around us, and enters our bodies at every breath, to keep us from living too fast, should be only willing to give up its independence, and supply matter for making new, or restoring wasted forms, when some organized substance contiguous is going to ruin. But, ordinarily, the animal system has not power to convert oxygen, hydrogen, carbon, and nitrogen into those *proximate elements* which are necessary to the repair of the wasted organs. The simple elements must first be resolved, through the agency of the vegetable world, into the proximates. Of these, *albumen*, the principle of the white of an egg, seems the most important, being largely found in the brain and other parts of the body. *Fibrine* is the chief material of the muscles. *Caseine* is that element of milk from which the young animal receives the constituents of its blood. Albumen, fibrine, and caseine are called compounds of *proteine*—the "starting point" of all the animal tissues—a compound of carbon, hydrogen, nitrogen, and oxygen, in which the relative proportions of these constituents are invariable. These compounds of proteine, which contain a small proportion of sulphur or phosphorus, or both, are produced in the vegetable organism, and "out of them the various tissues and parts of the body are developed by the vital force, with the aid of the oxygen of the atmosphere and the elements of

water." Water is composed of one part by volume and eight parts by weight of oxygen, and two parts by volume and one by weight of hydrogen. Some mineral matters are utilized in forming the tissues. Albumen, fibrine, and caseine are so largely found in the blood as to be considered its proper constituents. They are required to be ready formed in the food, whether vegetable or animal. There is another nitrogenized compound, produced especially in the grains, called *gluten*, which is of great use in the animal economy. It gives the dough of wheat flour that adhesiveness which makes it rise so well for bread. When gluten is dissolved in alcohol, and water is added, there falls to the bottom of the vessel a white substance resembling albumen, called *glutine*, or vegetable gelatine. Vegetable fibrine and vegetable caseine are also components of gluten, which sometimes contains also a fatty substance.

We have now mentioned four nitrogenized or flesh forming proximates—three simple and one compound—and five other organic substances, ready formed in vegetables, and not containing nitrogen—starch, sugar, gum, dextrine, and oil, which are called heat or fat producing compounds. *Oil* is especially fitted for the production of animal fat, which, as a rule,* contains no nitrogen. *Starch* is a well known substance, insoluble in cold water, which seems also, according to a distinguished physiologist, after undergoing some changes, to assist in forming the *bile*, one of the most important of the animal fluids. He asserts that brain and nervous matter are "formed in a manner similar to that in which bile is produced, either by the separation of a highly nitrogenized compound from the elements of blood, or by the combination of a highly nitrogenized product of the vital

* One of the exceptions is the fat of the brain, mainly a compound of soda with cerebric acid, which contains 2⅓ per cent. of nitrogen. —*Liebig's Animal Chemistry.*

process with a non-azotized compound (probably a fatty body)."

Dextrine, into which starch is converted by "diastase and acids," has a gummy appearance; has the same components as starch, and easily changes into sugar.

INORGANIC MATERIALS.

Phosphorus is found in the bones and elsewhere, combined with oxygen, as *phosphoric acid*, and this usually with lime or magnesia as a *phosphate*. *Sulphur* is utilized in the muscles, hair, etc.; *chlorine* in the *gastric juice*, milk, etc. (it being one of the constituents of chloride of sodium, or common salt). Other *inorganic* materials are compounds of oxygen with metals; as *potassa*, *soda*, *lime*, *magnesia*, and *silica*, being oxides respectively of potassium, sodium, calcium, magnesium, and silicium. *Potassa* (potash), and *soda* are found in the bile and other fluids; lime, in the bones, combined with carbonic and phosphoric acids, (carbonates and phosphates). *Silica* or *silex* is one of the components of *hair*.* The red globules of the blood owe their coloring matter to *iron*. Some other inorganic elements, as *fluorine*, are found in minute quantities in the system. All these substances are furnished by the grains and other vegetable substances; but common salt seems necessary to keep the living frame in the best condition, and is very much prized by man and his domestic animals.

The process of digestion in the human system may be briefly described as follows: The food, mixed with saliva from the salivary glands, after being well masticated and swallowed, is shaken up in the stomach by the contraction of its muscular fibres, and, being dissolved by the gastric juice from the lining membrane, is reduced to the state of

* Cutter's *Anatomy*.

chyme. This, in successive portions, is transmitted into the duodenum (the highest part of the intestinal tube), which supplies the chyme with mucus, while it receives bile from the *liver* and pancreatic juice from the *sweet bread*, and becomes *chyle*, (except what passes as residuum into the large intestines to be excreted). The lacteal vessels, (their extremities abutting on the upper part of the small intestine), absorb the chyle, and transmit it through the mesenteric glands into the thoracic duct, which conveys it to a large vein on the left side of the neck, where the internal jugular vein joins the subclavian.* There the chyle is mixed with venous blood, and then carried to the right auricle of the heart, the motion of which drives it into its right ventricle. From the right ventricle it is forced into the pulmonary artery, which conveys it to the lungs, where it meets the inhaled air, and is changed from venous into arterial blood of a bright red color. The pulmonary veins then carry it to the left auricle of the heart, from which it is forced into the left ventricle, and then into the aorta, or great arterial trunk, and through its branches permeating the whole system, into the capillary blood vessels, from which the different tissues of the living frame take up the needful new matter. The old waste matter of the tissues is removed by the *lymphatic vessels*, which carry it, or a portion of it, into the thoracic duct, to be mixed with the venous blood in its return to the heart. The lungs and kidneys aid each other in purifying the blood; the former by removing an excess of carbon, the latter by draining it of chemical compounds produced as the change of matter goes on.

As to the processes of digestion in domestic animals, the discussion will be more proper in treating of cattle and other feeding. It may be said here, that however little the *porcine*

* See Bushnan's *Physiology.*

system has in common with the human physical system, the digestive apparatus has a similar simplicity in each; that the horse has a comparatively small stomach, calculated for rapid digestion of more concentrated food taken in more frequently, and developing more heat and activity; the aids to his stomach being of large size and great power; that the ox, cow, and sheep have each four stomachs, fitted for receiving large quantities at once; the food suited to them being coarser and more bulky, and the power of rumination to reduce it being a special gift. The crop and gizzard of the fowl are too well known to need mention.

As material for the digestive process, a due proportion of animal and vegetable products is probably best. Leaving out of view Nature's milk for her newly born, an exclusive diet of animal food is not favorable, except for the carnivora. Grain, that furnishes bread as well as forage, is the great resource of nations that improve most rapidly in all that ennobles humanity. The hunter lives from hand to mouth, and slaughters unmercifully and often wastefully, and dies out before the march of the planter. The great advantage of animal food is that it requires less preparation, when freshly killed, to prepare it for the stomach. Some kinds are more stimulating; others *may be* better fitted for weak digestive organs than most vegetable food; but there is an excessive use of animal food which is unfavorable to health and good morals. What are technically called vegetables stand not far off from grain in the service they render to man and his subordinates. Grain has the advantage of being both seed and food in a highly concentrated form. Wheat has the broadest reputation in this respect; yet, though it has attained a much wider usefulness as a bread crop, it can not compare with Indian corn in the extent and variety of its uses as food for man and his domestic animals. This will more fully appear when we have considered the

history and varieties of *maize* — a name for the latter grain more accordant with its origin. Although no chemical analysis can reveal its desirable qualities with such truthfulness as the past and present of Indian corn, it may be more in keeping with the foregoing to give here certain results of ultimate analysis, as follows, (being condensed from tables appended to *Liebig's Animal Chemistry*, published in this country more than thirty years ago):

I.

HEAT PRODUCING OR NON-AZOTIZED COMPOUNDS.

In 100 parts, by weight of	Starch from Maize.	Grape Sugar.	Cane Sugar.	Hogs' Lard.	Gum.
Carbon, . . .	44.27	36.80	42.39	79.098	42.37
Hydrogen, . .	6.67	7.01	6.53	11.146	6.63
Oxygen, . . .	49.06	56.19	51.07	9.756	50.92

The proportions of cane sugar, hogs' lard, and gum, averaged from several authorities quoted by Liebig. *Azotized* (from *azote*) describes those compounds containing nitrogen.

II.

FLESH FORMING OR AZOTIZED PROXIMATES.

When it is considered that the analyses can only be approximately correct, the slight difference in the figures for these substances, said to be identical in composition, will be accounted for.

In 100 parts of	Fibrine.		Albumen.		Caseine.	
	Animal. Scherer.	Vegetable. Scherer.	Animal. Scherer.	Vegetable from Wheat Jones.	Animal from Fresh Milk.	Vegetable. Scherer.
Carbon,	54.45	54.60	55.46	55.00	54.823	54.138
Hydrogen,	7.069	7.302	7.201	7.23	7.153	7.156
Nitrogen,	15.762	15.809	15.673	15.092	15.628	15.672
Oxygen, Sulphur & Phosphorus	22.715	22.083	21.655	21.84	Oxygen & Sulphur. 22.394	23.034

It will be seen that fibrine and albumen are credited with both sulphur and phosphorus; caseine, with sulphur only.

Composition of proteine averaged from seven analyses by Scherer:

III.

In 100 Parts—by Weight.		The Proteine Samples Taken,
Carbon, ...	54.983	1st, from the crystalline lens.
Hydrogen, ...	7.085	2d, from albumen.
Nitrogen, ...	15.809	3d, from fibrine.
Oxygen, ...	22.118	4th and 5th, from hair.
		6th and 7th, from horn.
	99.995	

CHAPTER II.

COMPARATIVE VALUE OF MAIZE AS FOOD. RESULTS OF ANALYSIS.

These will depend very much on the variety analyzed, its ripeness, or degree of dryness, and other circumstances, as well as the skill of the operator. Sir Humphrey Davy, one of the earliest analysts (U. S. P. O., 1855), credits maize with about 77 per cent. of nutritive matter, as compared with the 95 per cent. of wheat. As the term "nutritive matter," however, with late writers, has generally a technical meaning, confining it to the flesh forming elements of food, his statement can not easily be placed by the side of later analyses. Two of M. Payen's are referred to in the Ag'l Reports; the first rating the quantity of oil in maize very high, and its nitrogenized elements very low. A critic mentions this as an error resulting from a misapprehension of the effect of *ether* employed to dissolve the oil. Another

of his is quoted in the Report for 1865, which gives maize about $71\frac{1}{2}$ parts in the 100 of starch, dextrine, and glucose; $12\frac{1}{2}$ of gluten and other nitrogenous matters; $8\frac{4}{5}$ of fatty matter; $5\frac{9}{10}$ of cellulose; and $1\frac{1}{4}$ of silica, phosphates of lime and magnesia, and soluble salts of potash and soda. Water, an item in most analyses, is not included. Professor Johnston, a British lecturer on Agricultural Science, credits maize with starch, gum, and sugar, 70 parts in 100; gluten, albumen, etc., 12; fatty matter, 5 to 9; husk or woody fibre, 6; other matters, $1\frac{1}{2}$; water, 14. This is more favorable than M. Payen's statement; for, if a similar quantity of water had been included in the latter's analysis, it would have reduced his other items considerably.

As early as 1847, Dr. Charles T. Jackson, of Boston, was noticed as having found more starch, flour, and albuminous matters in Southern white maize, and more oil and gluten in the yellow, hard maize of the North. Some of his analyses will be found in United States Agricultural Report, 1857. Dr. Salisbury, of Albany, N. Y., is a distinguished analyst of this and other products. His analyses of five varieties of Indian corn appear in Agricultural Report, 1849–50, and will be quoted herein under the head of varieties. Various other analyses of the maize plant, in its different stages, and of its different parts, are scattered through the Reports, some of which we shall use in what are deemed appropriate places. The greater part of them, however, are designed to represent the fattening properties of this plant, or rather its fitness as food for domestic animals. Those varieties most used as human food seem generally to be left in the background. Aside from corn meal, for a long time so large an item of consumption in the South and other parts of the Union, the use of this grain as hominy, and green corn boiled or roasted, has been very considerable, even in the cities, where wheat flour, in the shape of bakers' bread

and pastry, has such predominance. Some analyses of *sweet* corn have shown a very large proportion of nitrogenous matters, as well as sugar, though very little starch, as compared with other varieties.* It is asserted that a sample of Golden Sioux contained 16½ per cent. of albumen, caseine, and gluten; and a small white Flint, 76½ per cent. of the fat producers—sugar, starch, oil, and gum; and that different analyses of maize show a difference of 6 to 8 per cent. in the albuminous and flesh forming substances, and of 15 to 16 per cent. in the fat and heat producing elements.—*U. S. Agricultural Report*, 1864.

The following shows the range of different classes of items, in analyses, from U. S. Agricultural Reports for 1843 and 1844, and 1847 to 1871 inclusive:

IV.

In 100 Parts.	Maize.	Wheat.
Nitrogenous or flesh forming substances,	7 to 16½	11⅔ to 20
Non-nitrogenous or fat " "	60½ to 80	50 to 68¾
Salts or mineral matters, . . .	1.31 to 2	1.2 to 3.02
Fibre, etc., ...	5	2.61 to 15
Water, ...	9 to 15	14.3 to 15.26

*See Prof. Norton on Agriculture.

THE FOLLOWING TABLE SHOWS THE RANGE OF ITEMS IN OTHER ANALYSES IN VARIOUS WORKS ON AGRICULTURAL SUBJECTS.

V.

In 100 Parts.	Indian Corn.	Wheat.	Rye.	Oats.	Buck-wheat.	Peas.	Rice.	Cab-bage.	Meadow Hay.	Clov'r	Whe't Straw	Pea Straw	Potatoes
Starch,	18 to 68	42 to 48	40 to 62¾	38 to 52½	45 to 65½	40 to 58½	70 to 72	2	3 to 4	3	1	4	15 to 22
Gum and Sugar,	6 to 8	9	14	5 to 7	5 to 8⅓	5 to 6	4	3	12	13	7	10	1½ to 2
Fat or Oil,	6 to 11	2 to 3	3	5 to 6½	4 to 0.4	2 to 3	1	½	3 to 3½	4	2	2	½ to 2
Proteine matter, Nitrogenous or Flesh forming substance	12 to 20	14¾ to 17	8 4-5 to 13	11 to 18	10 to 10.2	22½ to 25	6 to 7	3	7	9	2	12	2
Vegetable Fibre,	9 to 14	10 to 15	15 to 16	15 to 33	23	9 to 10	4	2	53	45	70	52	5
Water,	12 to 14	12 to 15	12 to 15	12.2 to 16	11	14 to 15	12 to 16	88	15 to 16	16	12	15	74
Ash, Minerals, etc.,	1½ to 2	2	1¾ to 2	2 to 3	1 2-5 to 2	2½ to 3	1	1½	8 to 9	10	6	5	1

Some writers designate the nitrogenous principle of maize as *zein*.

As to the inorganic elements of maize and maize stalks, the result of several analyses is that the grain has 1⅓ to 2 per cent. of ash (after burning), and the stalks nearly 5 per cent. The quantity of ash varies with the place of cultivation; varies also in different plants, and different parts of the same plant; that of the grain being largely phosphates, lime, magnesia, and potash; that of the stalks largely silica. 6000 grains of corn yield 100 of ashes.

The following table, with the columns headed as follows:

VI.

In 100 Parts.	Indian Corn.				Wheat.	Rye.	Oats.
	a	*b*	*c*	*d*	*e*	*f*	*g*
Potash and Soda,	30.8	32.48	P23.92 S22.59	27.93 1.83	33.87	33.91	19.25
Phosphoric Acid,	50.1	44.87	*35.5	45.6	46	46.34	18.19
Lime,	1.3	1.44	0.16	2.28	3.4	4.19	3.92
Magnesia,	17	16.22	2.41	14.98	12.3	11.17	7.70
Silica,	0.80	1.44	9.50	1.88	3 35	3.36	47.08
Sulphuric Acid,		2.77	4 38	1.30	0.33	0.71	1.29
Oxide of Iron,		0.30		1.26	0.79	1.25	0 64
Chlorine,			0.40	1.42	0.09		†0.34
Organic matter,			0.36				
Totals,	100	100.12	99.23	98.48	100.13	100.93	98.41

Ashes, Wheat 1.67 to 1.93, Rye 1.36 to 1.60, Oats 2.9 to 3.02.

*Phosphate. †Chloride of Sodium and Potassium.

a—Analysis of maize ash, from Letellier in U. S. P. O. Report, 1860, the plant analyzed cultivated at Bechelbronn

b—Average of two analyses of same, from U. S. P. O., 1860.

c—Dr. Salisbury's analysis of ash of flint corn.

d—Average of nine analyses, ash of maize, from E. Wolff.

e—Average of thirty two analyses of ash of wheat.

f—Average of three analyses of ash of rye.

g—Average of seven analyses ash of oats grain.

All mentioned in the U. S. Agricultural Reports.

The analysis of maize straw in the following table is from U. S. Agricultural Report, 1860, and credited as a mean of two analyses by Hruschauer, as of Styria. Other analyses, by American authorities, of maize stalks, leaves, cobs, etc , from the U. S. Agricultural Reports, may be quoted hereinafter.

VII.

Analysis of Maize Straw, compared with Wheat Straw, averaged from European and American authorities.

In 100 Parts.	Maize Straw.	Wheat Straw.
Potash, ...	9.62	13.07
Soda, ...	26.30	0.71
Magnesia, ...	6.64	3.01
Lime, ...	7.97	6.23
Phosphoric Acid, ...	17.08	4.44
Sulphuric Acid, ...	1.19	4.05
Silica, ...	26.97	66.92
Peroxide of Iron, ...	0.81	0.74
Chloride of Sodium and Chlorine, .	3.42	1.00
	100.00	100.17
Ashes, ...	4.40	4.85

The above table shows the superior virtues of Indian corn fodder for feeding domestic animals. The amount of phosphoric acid is nearly four times that of wheat straw, and of soda more than twenty times. It is the right material for the heavy bones of the ox, and for making good his enormous consumption of bile. The large proportion of silica in wheat straw is doubtless necessary to insure a firm standing during growth.

CHAPTER III.

EARLY HISTORY OF THE MAIZE PLANT.

THE origin of Indian corn, as well as that of wheat and other grains, is hid in the mist of long gone ages. Was it indigenous to the Old or New World? Some have claimed it for the former, supposing it to be the Roman *far*,* one of the three chief grains credited to ancient Roman agriculture, or the bread corn mentioned in Isaiah xxviii. Others have conjectured that the Mohammedans brought it into Asia Minor after the taking of Constantinople. The only ground for this last supposition is the name it commonly bore throughout the continent, of *ble de Turquoise*. The best authorities, however, agree that it was first known to the Old World after the discovery of America. One or two statements have been made to the contrary, but in 1853, it was denied that it was mentioned by any ancient author, or found in any ancient monument, or represented in any ancient work of art, of the Old World. The reverse of all this is true in regard to its connection with the New World. The New World records and monuments, and paintings and sculptures testify to its existence within its limits from time immemorial. But this grain that was not mentioned in the *Ortus Sanitatis*, of Joan di Cuba, a singular work on plants, trees, etc., issued in 1471,† was so much of a novelty, a few years later, when imported by Columbus and his successors, that it spread very rapidly throughout Europe and Asia.

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* See Loudon's *Encyclopedia of Agriculture.*

† See Wilson's *Rural Cyclopedia;* Prescott's *Peru;* U. S. P. O., 1853, *Indian Corn; ditto*, 1859; Dr. Unger's *Plants for Food of Man, etc.* Lindley's *Botany;* D. J. Browne's *Memoir.*

Had it been a *native* of either of these continents, its culture would have been by this time much more fully wrought into the habits of their peoples, and its uses and advantages better understood and appreciated. But, the better European authors now admit that it is a gift of the New World to the Old; and Loudon, the Encyclopedist, describes it as the New World's *best gift*, giving food to a greater number of the human race than any other of the cerealia, except rice.

(*a*) *Incidents of its Discovery by Columbus and his Successors.*—Cat Island, of the Bahamas, furnished the first landing place for the discoverer of America. It was then the Guanahani of the natives. In answer to his inquiries for gold, they pointed to the south. Several of them accompanied him in his voyage thither. Touching at a point on the coast of Cuba, he sent an embassy to the king, in the interior, which returned with the report of fields cultivated with sweet pepper, and this strange grain, which in Hayti, the island next visited, was called *mais* or *mahiz.* When, in 1494, the natives of Hayti were brought under the yoke of the Spaniards, the former combined to starve out the intruders by neglecting the culture of this and their other usual food plants, and came near starving themselves. In his third voyage (1498), Columbus sailed inside of Trinidad, and received from the natives presents of maize, bread, and other eatables. In his fourth voyage (1502), in August, he was doubtless similarly entertained; for he found, as he sailed along the coast of Honduras, near the cape of that name, one hundred Indians, laden with the same comforts, with the addition of fish and fowl. In October of the same year, on the coast of Puerto Bello, three small islands and the main land opposite were seen cultivated with Indian corn and fruits. Passing Veragua, in 1503, he formed a settlement near the river Belen, where the plantain and pine apple and maize were abundant. The Cacique of Comagra,

near Darien, whose dwelling was 150 paces long and 80 paces wide, with storerooms, in one of which were beverages made of Indian corn, found a visitor in Vasco Nunez, who afterward (1513) discovered the Pacific Ocean. It was Pedro Martyr, a cotemporary of Columbus, who published an account of his first voyage, and stated that *mais* was the name given by the natives to the Indian corn found cultivated among them.

(*b*) *Maize as first seen by the Conquerors of Mexico and Peru.*—In his first adventure (1518), when Cortes reached the heights that revealed, in the distance, the capital, Tenochtitlan, he witnessed, beyond the vast intervening forests, the fields of this noblest of cereals in its most glowing colors. When he partook of the hospitality of Montezuma, he had a view of its products in the course of solid dishes, followed by one of sweetmeats and pastry. Out of maize flour, eggs, and sugar from the aloe, the Aztec cooks made famous dishes.* Cortes found ready dressed in the markets of Mexico, "pastry, bread of Indian corn, cakes, and confectionery." Pizarro, who landed at Panama, in 1526, and conquered a march through Peru, in 1533, was frequently charmed with the beauty of the hillsides, clothed with this grain in all its stages, from the green and tender ear to the yellow ripeness of harvest. The Peruvians, it was stated, although acquainted with the various methods of preparing maize, did not use it for bread except at festivals, but made a sort of honey from the stalk, and strong drink from the grain. Four leagues from Cuzco, the capital of Peru, was Yucay, the favorite residence of the Incas. Here, at a great elevation above the sea, was a natural garden full of the richest plants and flowers of the temperate overhanging the torrid zone. In the midst of it was the

*See Prescott.

artificial "garden of gold and silver," with an artificial field of Indian corn, in all its beauty of outline, faithfully sculptured in these precious metals. The Inca was captured; and, to meet the blood-thirsty adventurer's demand for a ransom, this wonderful work of art was broken up and melted down.*

(*c*) *Maize as a Tradition Among the Ancient Peruvians.*—The cultivation of maize in Peru extends back of all records. The Peruvians were an agricultural people. At one of their great annual festivals, the Inca proceeded to the environs of Cuzco, and, in presence of all the people, turned up the earth with a golden implement that answered for a plow. As the ancients of the East had traditions of the gift to mankind of their several bread plants, with the right methods of culture, by their gods; East India of the gift by Brahma; Egypt, by Isis; Greece, by Demeter; and Italy, by Ceres—so had the Peruvians of the gift of maize by Manco Capac.

This first of the Incas taught some of his subjects the arts of house building and tillage. Their country was part of those vast elevations not far from Lake Titicaca, which is overlooked by one of the highest mountains in the world, and though in the Torrid Zone, was surrounded by tracts too cold for maize production. But they leveled the land and cleared it of rocks and stones; brought manure from afar and applied it to their gardens, which were artificially covered with good earth, and maize culture became a success. Of its products they sent presents to the Temple of the Sun, at Cuzco, and to the Select Virgins, chosen for their royal lineage and beauty—a sacred order, completely shut out from the world at their home in that city, and visited only by the Queen and her daughters. These offerings the Vir-

* U. S. P O. Report, 1853.

gins had orders to distribute in all other sacred places through the realm, some being planted in gardens belonging to the Temple and other public edifices, and some divided among the people. A portion stored in the royal and public granaries was believed to possess a divine virtue, giving increase to the corn with which it was mixed, preserving it, and making it more wholesome for human food.* During the month corresponding to our July the subjects of the Inca made ready the ground for planting, and emptied their *chica* (a drink brewed from maize) into the aqueducts and rivers, as a sacrifice to obtain sufficient water for their fields.

†During the next month (*Capac Asitua*), our August, they began planting corn, &c., which they finished in their last month (*Capac Raymi*) November. At the feast, *Cusquic Raymi* (Winter Solstice), they prayed the Sun to shield the planted corn from excessive heat. In *Agrihuay* (April), which signifies an ear of corn with divers colors, the harvest came in, with dancing, music and out-pourings of chica, and the distribution of premiums for the finding of certain colors in grains of full ears, the lucky ones receiving a national ovation. In *Aymuray* (May), the corn was taken to the public depositories amid festive games, and the cultivators began pulling up the stubble. But their greatest feast was *Intep Raymi*, at the Summer Solstice, which was preceded by a three days' fast on a little white corn and a certain herb. Bands of women were detailed from the provinces to cook for the great throngs at the capital, and especially to knead the *Zancu*, a cake of boiled maize, eaten only at the solemn feasts. The same food, with other dishes, was prepared for the Court of the Incas by the Virgins of the Sun. The Indians of Peru were not mere Sun worshippers. In harvest

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*Garcilasso de Vega, a descendant of the Incas, and early Peruvian historian; quoted in Allen's American Farm Book.

†Peruvian Antiquities.

time they offered to the Earth corn and chica, and prayed for a good harvest. They threw corn into the river they were about to cross, or fish in, to propitiate its god. Among the idols of these Indians were the *Canopas*, to some of which *Zara* (maize) gave figure—such as stones cut in the shape of ears of corn. Idols made of cornstalks and clothed with an Indian mantle, were called *Zaramana*. Cornstalks with many or double ears, and ears with grains of many colors, or so ranged in rows as to form a cone, were held sacred, but not as deities. The ancient Peruvians buried with their dead, in round earthen pots, chica and corn as food.

(*d*) *Myths of the North American Indians touching the same corn.*—The tradition of the Ojibwas, as given by Schoolcraft, is a fair illustration.*

"A young man went out into the woods to fast, at that period of life when youth is exchanged for manhood. He built a lodge of boughs, in a secluded place, and painted his face of a sombre hue. By day, he amused himself walking about, looking at the various shrubs and plants; and at night, he lay down in his bower, which being open, he could look up into the sky. He sought a gift from the Master of Life, and he hoped it would be something to benefit his race. On the third day he became too weak to leave the lodge, and as he lay gazing upwards, he saw a spirit come down in the shape of a beautiful young man, dressed in green and having green plumes on his head, who told him to arise and wrestle with him, as this was the only way in which he could obtain his wishes. He did so, and found his strength renewed by the effort. This visit and the trial of wrestling were repeated for four days, the youth feeling, at each trial, that, although his bodily strength declined, a moral and supernatural energy was imparted, which promised him the final victory. On the third day his Celestial visitor

spoke to him. "To-morrow," said he, "will be the seventh day of your fast, and the last time I shall wrestle with you; you will triumph over me and gain your wishes. As soon as you have thrown me down, strip off my clothes and bury me on the spot, in soft and fresh earth. When you have done this, leave me, but come occasionally to visit the place to keep the weeds from growing. Once or twice cover me with fresh earth." He then departed, but returned the next day, and, as he had predicted, was thrown down. The young man punctually obeyed his instructions in every particular, and soon had the pleasure of seeing the green plumes of his sky visitor shooting up through the ground. He carefully weeded the earth and kept it fresh and soft, and, in due time, was rewarded by beholding the matured plant, bending with its golden fruit, and gracefully waving its green leaves and yellow tassels in the wind. He then invited the parents to the spot to behold the new plant. "It is Mondamin," replied his father; "it is the spirit's grain." They immediately prepared a feast and invited their friends to partake of it, and this is the origin of Indian corn."

(*e*) *Maize in the Early American Colonies.*—The first European settlement made in the territory of Pennsylvania, was in 1584, and rich fields of maize were even then found cultivated by the natives. The aborigines taught, (U. S. Agricultural Report, '59), the original Dutch and English settlers in America the uses and culture of maize, and they gave names to many of its varieties. In North America it was first successfully cultivated by the English in 1608, on James River; the colonists of the London Company following the methods then practiced by the Indians. Two hundred to a thousand fold was said to have been the yield on a crop of thirty or forty acres raised near Jamestown by the Colonists.

(*f*) *Captain John Smith's Account of Indian Maize Culture.**—" The Indians divide the year into four seasons. Their winter some call *Popanow;* spring, *Cattapeuk;* the summer, *Cohattayough;* the earing of their corn, *Nepinough;* the harvest and fall of leaf, *Taquitock.* The greatest labor they take is in planting their corn, for the country naturally is overgrown with wood. To prepare the ground, they bruise the bark of the trees near the root; then they scorch the roots with fire so that they grow no more. The next year, with a crooked piece of wood, they beat up the weeds by the roots, and in that mould they plant their corn. They make a hole in the ground with a stick, and into it they put four grains of wheat† and two of beans. These holes they make four feet, one from another. Their women and children do continually keep it with weeding, and when it is grown middle-high they hill it about like a hop-yard. In April they begin to plant, but their chief plantation is in May, and so they continue until the middle of June. What they plant in April they reap in August; for May, in September; for June, in October. Every stalk of their corn commonly beareth two ears; some three; seldom any four; many but one, and some none. Every ear, ordinarily, hath between two hundred and five hundred grains. The stalk, being green, hath a sweet juice in it, somewhat like the sugar-cane, which is the cause that, when they gather their corn green, they suck the stalks; for, as we gather green peas, so do they their corn, being green, which excels their old. They plant also peas they call *assentamens.* Their corn they roast in the ear green, and bruising it in a mortar of wood with a polt, lap it in rolls in the leaves of their corn, and so boil it for a dainty. They also preserve that corn late planted, that will not ripe, by roasting it in hot ashes, the heat thereof drying

*See his History of Virginia, &c. †Maize.

it. In winter they esteem it, being boiled with beans for a rare dish they call *Pausa Rowmena.* Their old wheat* they first steep a night in hot water, in the morning pounding it in a mortar. They use a small basket for their Temmes,† then pound again the great, and so separating by dashing their hands in the basket, receive the flour in a platter made of wood, scraped to that form with burning and shells. Tempering this flour with water, they make it either in cakes, covering them with ashes until they be baked, and then washing them in pure water, they presently dry with their own heat, or else boil them in water, eating the broth with the bread, which they call *Ponap.* The groutes and pieces of the corn remaining, by fanning in a platter or in the wind, the bran they boil three or four hours with water, which is an ordinary food they call *Ustatahamen.* But some, more thrifty than cleanly, do burn the core of the ear to powder, which they call *Pungnough*, mingling that in their meal, but it never tasted well in bread nor broth. In May, also, amongst their corn, they plant *Pumpeons.*"

Under date of May 28, 1620, Captain Smith asserts that, "Whatsoever is said against the Virginia corn, they find it doth nourish better than any provision that is sent thither."

(*g*) *Maize and the Pilgrim Fathers.*—The Plymouth Colonists, a few days after their landing at Cape Cod, in 1620, are said to have stumbled on a quantity of Indian corn, buried in the ear, after the manner of the natives, near the site of a recent hut, under hillocks of raised earth, which were at first mistaken for graves. In 1621 the Pilgrims, now settled at Plymouth, had a visit from the Indians, Samoset and Squanto, who gave them lessons in corn-planting and manuring. They obtained a good yield from twenty acres in maize. In the same year, Messrs. Winslow and Hopkins

*Maize. †Sieve.

were feasted by the Indians at Namasket on corn-bread called *mazium*. In 1629 Massachusetts Bay produced fifty-two hogsheads of this corn, seven bushels each, from thirteen gallons of seed—two hundred and twenty-four-fold.

(*h*) *Prices of Indian Corn in the Colonies of Virginia and Massachusetts Bay.*—In 1621 maize sold in Virginia for 2s. 6d., or 62 cents per bushel. This was two years after the first General Assembly for that Colony was called by Governor Yardley, the result of which was a great increase of private enterprise. The Records of the Colony of Massachusetts Bay state that on the 28th of September, 1630, at a Court of Assistants, it was ordered "that noe person inhabitting within the lymitts of this patent shall, either directly or indirectly, give, sell, trucke or send away any Indian corn to any English without the lymitts of this patent, or to any Indian whatsoever, without license from the Governor and Assistants." In June, 1631, persons were prohibited from buying corn out of ships coming into the bay without such leave. October 8th, corn was made a legal tender, unless money or *beaver* was expressly named. 1633, April 1st, at a court held at Boston, it was ordered that the "price of corn, formerly restrained to 6s. the bushell, is now sett at liberty to be sold as men can agree." November 5, price set at 6s. till next court; 1634, March 4, price fixed at 5s. in payment of taxes—no Indian corn to be sold above 6s. per bushel, under penalty of forfeiture. April 1, price left open; in September, 1636, March and April, 1637, price fixed at 5s. for taxes, and at last date, same for all subsequent bargains; but on 1st of August, "price of corn set at liberty." Nov. 2, it fell to 3½s. for taxes. In 1638 those planting were to secure their corn in day-time, but owners of cattle hurting the crop at night to pay damage. 1640, May 13, "Good ould Indian corn growing *hear* 5s. the

bushell." In October, 1641, the price was again set at liberty. Servants and workmen's wages were ordered to be paid in corn; if parties could not agree on the price, it was to be "valued by two indifferent freemen, to be chosen, the one by the master, the other by the servant or workman, and if they can not agree, then a third man is to be chosen by the next Magistrate," &c. At a General Court in March, 1648, Benedict Arnold was given leave to take up fifty barrels of Indian corn for "suppliing ye Indians," who were to pay in wampum. In the following May, there not being sufficient for necessary "sustentation" of the inhabitants in all the towns for two months, this and other grains were forbidden to be transported out of the jurisdiction. In May, 1649, a committee was appointed to secure a magazine of corn. In October of the years successively from 1647 to 1650, Indian corn, for taxes, was 3s. per bushel. In 1650 "wheate and barly" five shillings, and rye and peas "fower" shillings. In 1651 the "country rate was payd" in Indian corn at 3s.; and also in 1652; and in 1654, if brought in after March 10; if before that, to be "accoumpted" 2s. 8d. The question of shrinkage had evidently been discussed. In 1652 orders were issued in regard to the mint, every shilling to weigh three-pence, troy weight, and lesser pieces proportionately, deducting allowance for "coynage;" Spanish coin to be melted and brought to the "allay" of sterling silver, (the just alloy of new sterling English money). In November, 1654, it was ordered that the loss by shrinkage of corn paid in for taxes should be borne by the towns. In May, 1655, complaints being made of short measure in dealings with the sailors, measurers of corn were appointed for the sea-ports. Two shillings sixpence was now allowed on taxes for Indian corn, and also in November following, "pajable" 10th of March. In October, 1656, 2s. 4d. was allowed; in 1657, 2s. 6d., fixed for all

payments;* in 1658, corn scarce and high, and law fixing price repealed, as between man and man; in October of 1660 to 1666 successively, 3s.; in 1667, 2s. 8d.; in 1670, 3s.; in 1674, for the country rate, 3s. was allowed; in 1675, 3s. 6d.; in 1676, 3s., and so on till 1685, except in 1681, when the fixed price for the country rate was 3s. 6d.

(*i*) *Prices in other Colonies.*—In New Netherlands, the country north of, and bordering on, the present New York City, the price of maize in 1650 was 10 to 15 stivers per skepel (15 to 20 cents per bushel). In Rhode Island (1670) it sold for 25 cents per bushel, there being a reign of plenty and continued peace. In 1680 the price was 75 cents per bushel on the Piscataqua River, the boundary between Maine (shortly before made a province of Massachusetts) and New Hampshire, which had, in 1679, become a separate royal province.

(*j*) *Maize in Wm. Penn's Colony.*—In the early colonial records of Pennsylvania it is stated that, at a provincial council, held 23d of first month, 1683, at Philadelphia, Wm. Penn, Governor, and others present, it was ordered that the seal of Kent county should be three ears of Indian corn, and that of Sussex county one wheat sheaf. At another council, held in the seventh month of same year, sundry bills were presented, including as items sundry bushels and barrels of Indian corn, as well as pounds of pork and tobacco.

(*k*) *Exports and Imports of Maize in the Colonies, up to their Independence, in* 1776.†—The Colony of South Carolina exported 39,308 bushels of Indian corn in 1748, and 16,428 in 1754. Philadelphia exported 90,740 bushels in 1752;

*Unless otherwise concluded by mutual consent. †U. S. P. O., 1853.

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60,206 in 1767, and 259,441 in 1771. North Carolina, in 1753, exported 61,580 bushels; Savannah 600 bushels in 1755, and 13,598 in 1770. Virginia's annual exports of same, for several years previous to the revolution, were 600,-000 bushels. Total exports of Indian corn in 1770, from this country, were 578,349 bushels. Into Piscataqua River were imported 6,498 bushels of same in 1765; 4,097 in 1769; 16,587 in 1770, and 4,096 in 1772.

In every part of the continent now occupied by the United States, the aborigines connected with our earliest history seemed to be familiar with the culture and consumption of Indian corn as food.

CHAPTER IV.

DISTRIBUTION OF MAIZE.

(*a*) In considering this, maize should be viewed under three aspects: 1st. As a bread corn; 2d. As supplying other forms of human food; and 3d. As forage, or food for domestic animals. As cereals, wheat and rice had divided the empire of the Old World between them, probably, for three thousand years, giving way, in certain districts and at certain elevations, to rye, barley and oats; when maize came from the New World and made rapid and extensive inroads on this empire; in Europe chiefly, where wheat ceased to be the exclusive bread corn, and widening southward; in Asia, where rice was not too firmly established, say in the south-west; in Africa, along the Mediterranean and Red Seas, and at the Cape of Good Hope, and prevailing, side by side, with rice in the Torrid Zone. Wheat, moreover, made inroads on the maize empire in America, after its discovery by Columbus, and cassava bread had already estab-

lished, in South America, a rival kingdom before that. Within the tropics maize will grow at the height of 7,200 feet above the sea level; but, according to Prof. Lindley—(Lindley's Botany), only predominates between 3,000 and 6,000 feet elevation—wheat abounding above the latter height, and rye and barley above that, up to 9,260 feet. Of five grand divisions of the earth's surface, as respects the bread plants, maize has the greatest range of temperature; rice supports the greatest number of human lives; the three other grand divisions being the wheat, the rye, and the barley and oats region.

As to the limit of successful maize culture Northward, European and American authorities differ. Loudon (1844) says that maize was then cultivated in "almost every part of the universe," where the summer temperature equals or exceeds that common to latitude 45 degrees, or even to 48 degrees. Lorin Blodget, the climatologist, (U. S. P. O. Rt. 53) makes "its profitable cultivation as a staple and in competition with the best products of the several districts," to be "very precisely defined on the north by a mean temperature of sixty-eight degrees for July." It appears, from eminent European authorities,* that maize, as a bread corn, prevails in Portugal, Spain, Southern France, Italy and Greece, the Levant, Arabia, East Persia and Northern India, and that it is common in Hindostan and Ceylon. China produces nearly all the European grains. Southern Russia exports maize, which is extensively grown on the shores of the Black Sea. It is grown in Moldavia, Wallachia, and Turkey generally; in Albania, Transylvania, Hungary and Austria. It has traveled in France since the time of Arthur Young, (1787), from latitude 48° 35′ (in a line connecting Bordeaux and Strasburg) to Nancy, in 49 degrees. The

*Loudon, Lindley, Wilson's Rural Cyclopœdia.

maize product in France for 1826 was 17,280,000 bushels; in 1841, 33,400,000 bushels. Some of its varieties have been shown, by experiment, to grow successfully in the north of France, Belgium, many parts of Germany, and in the southern and central parts of England. As a forage plant, the celebrated German, Thaer, long ago, recommended its culture.

(*b*) *Maize in England.*—It had been cultivated for upwards of a century before Loudon's time, in the neighborhood of London, to supply the seedsmen throughout Great Britain with ears to ornament their shop windows. It was also grown for roasting-ears in the kitchen gardens of some who had lived in America. Cobbett, in 1828 and 1829, did much to draw attention to its cultivation. The results as to field culture were not then considered very successful, because the heat of the months in which it usually ripens was of too low a range. These efforts bore fruit in later years; cautious and judicious experimentalists, as far back as 1853, had proved that the *maiz quarantine and maiz d' poulet* were quite suitable for many districts in the southern and midland counties of England, and could be easily acclimated in more backward districts, and that other and better varieties could, in a similar way, be introduced into Southern England. Parts of Wexford, Waterford and Kilkenny were thought as favorable for this culture as South-west England.

(*c*) *In Africa, &c.*—Morocco and the other Barbary States, Egypt and Nubia are enumerated as maize districts, and in parts of the South this grain is very productive. It is a success in the Canary Islands. It is a specialty in New South Wales, and is succeeded in the same season, in Mauritius, by a wheat crop.

(*d*) *In the New World.*—In the West Indies maize grows very luxuriantly, but is probably not so profitable a crop as in the United States. Cuba produces two crops in a year on the same ground, and the forage crop is very abundant. It is grown in Jamaica in fields by itself, and in fields mixed with other plants. On the continent south of the Tropic of Capricorn, it is produced in Paraguay and Chili. The Valparaiso variety, (akin to popcorn) is named from one of the Chilian seaports. It is also grown in Brazil, Bolivia, French Guiana. In Peru it is still extensively cultivated for human food, as well as for cattle and swine. Maize is among the plants grown abundantly in Guatimala. It is largely cultivated and consumed in Mexico by the descendants of the people conquered by Cortez. These people raised it in floating fields, on the lake near the capital. Sonora, in 1864, is spoken of as one of its most barren States, and yet there are choice spots, especially along the rivers, where, under very simple culture, with very old-fashioned implements, the maize and bean fields, without manure, rarely, or never fail to produce two crops in the year. In the United States domain the existing Indian tribes have, as a rule, kept up the maize culture after their several removals.

In the Indian Territory, so-called, south of Kansas, there was raised, in 1868, of this corn, 31,700 bushels, valued at $24,000; in 1872, 214,190 bushels, valued at $106,998, (see U. S. Agricultural Report, 1870). The ruins of the Pueblo villages show that the culture of some varieties had been continuous for centuries past. Up to 1870 maize was still the staff of life to the Indians of Arizona, California, Nevada and Utah. Indian corn in British America is not the article it is in the United States, but it is much cultivated in Canada, and to some extent in Nova Scotia and New Brunswick, and also on the Saskatchewan, near Lake Winnepeg. Only the smaller and earliest ripening kinds succeed there,

unless, by acclimation, others have been lately introduced. The value of exports from the British American Colonies of maize and meal for the year ending 30th June, 1849, were stated as $600,000.

CHAPTER V.

STATISTICAL HISTORY OF MAIZE IN THE UNITED STATES.

(*a*) Probably it is a safe rule that a soil or climate, taken on an extensive scale, will produce that which is most needed for the sustenance of the inhabitants. For a very high latitude more of a meat diet is required, to restore the great waste of the system resulting from the amount of movement necessary to keep life in the body. Hence in Arctic regions population is thin and animal food comparatively abundant. For high latitudes, lower than the above, a concentrated and richly endowed grain, like wheat, or, still better, some varieties of oats, may be more suitable. Not only the latitude, but the elevation, has much to do with the nature of the food plant, as well as its capacity for production. Other circumstances modify the effects of latitude and elevation, such as the situation with reference to large rivers and mountains, and to ocean and lake shores. For the more temperate, as well as high tropical regions, the average maize is better, because, though not so highly concentrated food, it has more elements suited to a life of temperate activity. On the whole, as the inhabitants of a country can best judge what productions of their soil best suit them, their estimation of any product will probably be shown by the extent of its planting, or acreage, the choice of soil, the pains taken to make it productive, and the capital invested in the manure, implements and labor applied—all expressed in the amount produced. The demand for it, shown in its

average price, is another witness in its favor, though, for several reasons, not as satisfactory, as far as general usefulness is concerned, as the former.

(*b*) The acreage of improved land is given by the census of the United States since 1840, but not, as a rule, the acreage of the several crops. Of these, in recent years, estimates in reference to acreage, product, value, yield per acre, and average price, have been annually made by the Agricultural Department. Previous to its establishment as such, about the year 1861, annual reports were issued on agricultural subjects, by the U. S. Patent Office, containing statistics of a more general character. These commenced with a thin volume in 1842, containing a small portion of agricultural matter, the rest relating to mechanical inventions. Some of the States have regular Boards of Agriculture, and give, in their annual reports, the maize products. Ohio has issued such reports for many years.

(*c*) It appears, from DeBow's Compendium of the Census for 1850, that the maize product for 1840 was 377,531,875 bushels, and the population being then 17,069,453, would give 22 1-9 bushels to each inhabitant of the United States. The following table shows, in column No. 1, the acres of improved land at the several decennial periods, beginning with 1850, as returned by the census of the United States: No. 2, the product of Indian corn in bushels; No. 3, bushels of same to each acre of improved land; No. 4, population of United States; No. 5, bushels of same to each inhabitant. The figures for Nos. 1, 2 and 4, for the census years 1850 and 1860, are taken from a work issued from the Government Printing Office in 1864, on the Agriculture of the United States, as shown in the Census of 1860, by Joseph C. G. Kennedy, Superintendent of same. The figures for 1870, of Nos. 1, 2 and 4, are from the large work containing that year's census:

VIII.

YEARS.	NO. 1.	NO. 2.	NO. 3.	NO. 4.	NO. 5.
1850.	113,032,614	592,071,104	5.25	23,191.876	25½
1860.	163,110,720	838,792,742	5.14	31.443.321	26⅔
1870.	188 921,099	760,944,549	4.03	38.558,371	19¾

The last census returns would make it appear that the ratio of the maize product to the acres of improved land, which remained nearly the same in '50 and '60, fell off nearly 22 per cent. in '70, and that the number of bushels to each inhabitant, which had increased from 22 1 9 in '40 to 26⅔ in '60, fell off 27 per cent. in '70, and that the maize product was diminished 9 per cent. from that of 1860. But it is well here to consider the effect of the census, as explained in the introduction to the agricultural returns of the last one. By improved land is meant that which is cleared and in use for grazing, grass, or tillage, or which lies fallow. Although the census professes to include all crops on the farm for the year, whether consumed at home or sold off, it claims a high degree of accuracy only as to crops of considerable importance. It does not appear to include the minor products of pop-corn, and varieties grown for roasting or boiling green, the sale of which is large in the chief towns and cities; nor the small crops of common corn raised in gardens, or fractional acres not considered as farms. Of these there is a great number in and about country towns not densely populated. The schedule for filling up through the officers of the census was found to be inapplicable to the State of Texas, some of the Territories, and some parts of California and Nebraska. It was formed "wholly with reference to the agricultural requirements of the older States, where land is divided up into well defined farms," and agriculture has become a system. It is often stated that the census being nominally for

the crops of the decennial year ending June 1, represents, actually, the preceding year's crop; but the authority above quoted asserts that it is made up "without any determinable proportion, indifferently of the production of two years;" in the census of 1870, for instance, being thus made up of the products of that year and 1869. In view of all this, the whole maize crop for any one year, outside of that grown only for fodder, green or dry, would seem to be more satisfactorily stated by the estimates of the Agricultural Department of the United States. The manner of making this will be hereinafter described. These foot up, for 1870, 1,094,255,000 bushels, giving 5 4·5 as the number of bushels to each acre of improved land; and 28½ bushels to each inhabitant; showing that the maize product keeps up with the population and with the improvement of farms.

(*d*) The following table of census returns of maize produced in the several States, including Utah and New Mexico, and leaving out West Virginia, for the four last census years, is made up of figures taken from the three authorities last above referred to, including the yield per acre, in bushels, returned by the Marshals in 1850, given in DeBow's Compendium.

These returns, as well as those of the Agricultural Department given in the succeeding pages, deserve careful study. Underneath these dry matters of statistics may be found the workings of some of the greatest events of our Nation's history. Among the earliest of these were the wide extension of our territory after the Mexican war; the discovery of gold in California; the rapid settlement of the grand prairies, and the more general introduction of labor-saving agricultural machinery so well suited to their cultivation. Their usefulness was more fully demonstrated during the later years of the civil war, when so large a proportion of the bone and muscle, as well as the brain, of the country

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was withdrawn from the labors of the plow to those of the sword. When confidence is fully restored, the census returns will doubtless be more complete :

IX.

STATES.	1840. Bushels.	1850. Bushels.	1860. Bushels.	1870. Bushels.	1850. Yield per acre
Maine . .	950,528	1 750,056	1,546,071	1,089,888	27
N. Hampshire	1,162,572	1.573,670	1,414.628	1 277,768	30
Vermont .	1,119 678	2,032,396	1,525 411	1,699,882	32
Massachusetts	1,809,192	2,345,490	2,157,063	1,397.807	31
Rhode Island	450,498	539,201	461 497	311,957	--
Connecticut	1,500 441	1,935,043	2,059.835	1,570.364	40
New York .	10 972,286	17,858,400	20,061.049	16 462,825	27
New Jersey .	4.361.975	8 759.704	9 723,336	8,745,384	33
Pennsylvania	14 240.022	19,835,214	28 196 821	34,702,006	20
Delaware .	2,099,359	3 145,542	3 892,337	3.010 390	20
Maryland .	8,233,086	10,749,858	13,444.922	11,701,817	23
Dist Columbia	39.485	65,230	80,840	28,020	--
Virginia .	34 577,591	35,254 319	38 319 999	17.649 304	18
N. Carolina .	23,893.763	27,941.051	30 078 564	18 454.215	17
S. Carolina .	14,722,805	16,271.454	15,065,606	7.614,207	11
Georgia . .	20.905.122	30.080 099	30,776 293	17,646,459	16
Florida . .	898.974	1,996 809	2,834 391	2,225 056	--
Alabama .	20 947,004	28 754 048	33,226,282	16,977.948	15
Mississippi .	13.161,237	22.446 552	29,057 682	15 637,316	18
Louisiana .	5,952,912	10.266 373	16 853 745	7,596,628	16
Texas . .	----------	6,028 876	16 500,702	20,554,538	--
Arkansas .	4 846 632	8,893,939	17 823.588	13,382,145	22
Tennessee .	44.986,188	52,276,223	52.089 926	41,343.614	21
Kentucky .	39,847,120	58.672,591	64 043,633	50.091,000	24
Ohio . . .	33 668,144	59,078,695	73 543 190	67,501.144	36
Oregon . .	----------	2,918	76 122	72.138	--
Michigan .	2 277 039	5,641,420	12,444 676	14 086 238	32
Indiana . .	28,155.887	52 964.363	71.588 919	51 094.538	33
Illinois . .	22,634,211	57,646 984	115,174,777	129 921 395	33
Wisconsin .	379,359	1.988,979	7.517.300	15.033,998	30
Minnesota .	----------	16,725	2.941 952	4 743,117	--
Iowa . .	1,406 241	8,656,799	42 410 686	68 935 065	32
Missouri .	17 332,524	36,214,537	72 892 157	66.034 075	34
Kansas . .	----------	----------	6 150.727	17 025 525	--
California .	----------	12 236	510 708	1.221 222	--
Utah . .	----------	9 899	90 482	95.557	--
Nebraska .	----------	----------	1 482 080	4 736 710	--
Nevada . .	----------	----------	460	9,660	--
New Mexico	----------	365,411	709 304	640 823	--

The crop of West Virginia, which was cut off from Old Virginia, after the completion of the census of 1860, was returned as 8,197,865 bushels; Washington Territory, 4,712 in 1860, and 21,781 in 1870; Dakota 20,269 in 1860, and 133,140 in 1870; Colorado 231,903, Idaho 5,750, Montana 320, and Arizona, 32,041 bushels in 1870. The census totals for the four last decennial years are given in table VIII., and the statement introducing it (*c*).

(*e*) The New England States seem to have reached their highest product of maize in 1850, or shortly before, and afterwards fluctuated to much lower figures. This was probably due to an increased investment of capital and labor in manufactures, or crops on the whole better suited to their climate and soil; and to the competition of cheap Western corn, reaching their markets by improved lake and canal navigation and a widely extended net-work of railroads. The Erie Canal, opened in 1825, gave a new impetus to inland trade. When the Ohio, Miami, Wabash and Illinois Canals were opened, with their respective branches, the Ohio and Mississippi Valleys and the shores of the Great Lakes were ready for the vast movements Eastward and Westward, and the aid and competition of the railroads followed hard after, to make them more effective and rapid. In 1863, Governor Andrew, of Massachusetts, in his message, estimated the supplies furnished New England by the West, of flour, grain and animal food, for human sustenance and forage for cattle, horses and swine, at $50,000,000, $20,000,000 of which went to Massachusetts.

(*f*) The civil war occasioned, for a time, a rapid diminution of the maize product in the States south and south-west of Maryland, except in Florida, Texas and Arkansas. They are gradually recovering from its effects, but cotton and sugar culture are gaining on maize in portions of the Gulf States. The Ohio and Upper Mississippi Valleys have shown

a wonderful development of maize culture. Tennessee was highest in 1840; Ohio in 1850, with Kentucky following close behind. Illinois came to the front in 1860, leaving Ohio, Missouri and Indiana nearly equal, but far behind. Illinois was still first in 1870, Iowa, Ohio and Missouri being next by the census, and Indiana, Missouri and Iowa by Agricultural Department's estimate.

(*g*) Closely connected with the statistics of Indian corn are those of swine. The following table, made up from the census authorities above named, gives the number of swine on farms for the four last decennial years. The fifth column, headed 1860 (*b*), shows the number of swine which the Assistant Marshals of the census of 1860 believed to have been omitted from their schedules, as not being connected with the agriculture of this country, but scattered through the cities and large towns.—(See Kennedy's Agriculture of that census).

West Virginia had 268,031 swine in 1870; Dakota 287 in 1860, and 2,033 in 1870; Arizona 720, Colorado 5,509, Idaho 2,316, Montana 2,599, and Wyoming 146, respectively, in 1870. The totals for the States and Territories of the above lists of swine, were—for 1840, 26,301,293; for 1850, 30,354,213; for 1860 (*a.*, official), 33,512,867; for 1860 (*b.*, additional), 3,467,905; for 1870, 25,134,569. The estimates of swine in large towns and cities, for 1860, as above, were made at the express direction of the Superintendent of that census, and were omitted in the previous one, and probably, also, in that of 1870. To obtain the fullest returns for 1860, they may be very safely added to the official returns headed 1860 (*a*), in annexed table. The ratio of estimates in the fifth column, to the official returns of 1860, is largest (17½ to 11) in the District of Columbia, which has in it very little of the rural element.

X.

STATES, ETC.	1840.	1850.	1860. (*a*)	1870.	1860. (*b*).
Maine . . .	117,386	54 598	54 783	45,760	21,196
New Hampshire	121,671	63,487	51 935	33 127	17 423
Vermont . .	203 800	66,296	52.912	46 345	18,526
Massachusetts	143 221	81,119	73,948	49,178	43,146
Rhode Island	30,659	19,509	17,478	14,607	7,242
Connecticut .	131,961	76,472	75 120	51,983	26,034
New York .	1,900,065	1,018,252	910 178	518 251	100,791
New Jersey .	261,443	250,370	236,089	142,563	71.516
Pennsylvania .	1,503,964	1,040,366	1,031,266	867.548	200,236
Delaware . .	74.228	56,261	47,848	39 818	7 969
Maryland . .	416,943	352 911	387,756	257,893	15,113
Dist. Columbia	--------	1,635	1,099	577	1.744
Virginia . .	1 992,155	1,829 843	1.599.919	674 670	198 121
North Carolina	1,649 716	1,812,813	1,883 214	1,075 215	206,976
South Carolina	878,532	1,065.503	965,779	395.999	--------
Georgia . .	1,457 755	2,168,617	2 036,116	988,566	375 350
Florida . .	92.680	209,453	271.742	158 908	26 092
Alabama . .	1 423 873	1.904 540	1.748 321	719 757	63,528
Mississippi .	1,001,209	1,582,734	1,532 768	814 381	3,175
Louisiana . .	323,220	597,301	634,525	338.326	50,755
Texas . .	--------	692,022	1.371,532	1,202,445	198,261
Arkansas . .	393,058	836.727	1.171,630	841,129	18,919
Tennessee .	2,926 607	3 104 800	2,347 321	1,828,690	108,577
Kentucky . .	2 310,533	2 891,163	2,330 595	1,838.227	234,255
Ohio . . .	2,099 746	1.964,770	2,251,653	1,728 968	317,116
Michigan . .	295 890	205,847	372 386	417 811	57 316
Indiana . .	1,623 608	2,263 776	3 099 110	1,872,230	146 034
Illinois . .	1,495.254	1,915 907	2.502,308	2,703 343	254 380
Wisconsin . .	51,383	159,276	334 055	512,778	70 866
Minnesota . .	--------	734	101 371	148 473	19,718
Iowa . . .	104,899	323 247	934,820	1,353 908	130.891
Missouri . .	1,271,161	1,702 625	2,354,425	2 306 430	412 368
Kansas . .	--------	--------	138 224	206,587	16 500
Nebraska . .	--------	--------	25,369	59 449	1,376
California . .	--------	2 776	456 396	444 617	3 762
Oregon . .	--------	30,235	81,615	119,455	10,728
New Mexico .	4 673	7,314	10 313	11 267	7,624
Utah . . .	--------	914	6 707	3 150	3 625
Nevada . .	--------	--------	3 571	3 295	--------
Washington .	--------	--------	6 383	17 491	656

The ratio of additional to official list in 1860 is next (3 to 4), in New Mexico, where the farms are not always well defined. Next (2 to 3), in Massachusetts, a State of many industries and abounding in cities and large

towns. Next, more than 1 to 2 in Utah's gardens. After these, 2 to 5 in Maine, and about 1 to 3 in the other New England States and New Jersey, where a large class of families, devoted to various callings, find the time and the means to feed their own pork. The ratio is 1 to 27 in Alabama. It seems probable that, in the Eastern States generally, what there is of swine raising is gradually getting out of the line of professional farmers into that of these domestic growers, and others who contrive to eke out the subsistence of this kind of stock by other methods than corn-feeding; and with good reason; for it has been asserted by good authority that, in New England and the Middle States, pork, up to the winter of '64-5, rarely bore a price at which marketable grain could be profitably fed to swine. But it is to be remembered that the mere number of swine does not tell the whole story. The probable improvement of their quality in the Eastern States since 1840 is, in some degree, indicated by the high prices of live hogs as compared with those of the South. In proportion to the population for the same year, the list of swine was larger in 1840 than it has been in either of the subsequent census returns. The result of a comparison of these in 1860 was that the Pacific States then formed the only one, of five or six leading sections of the Union, where the number of swine kept pace with the advance of population. But, out of forty-one States and Territories of which the official census returned the number of swine in 1860, thirty returned less in 1870, and eleven more. Of these eleven all, except Michigan, Illinois and Wisconsin, were west of the Mississippi. Iowa shows the largest increase; but this did not keep pace with its advance of population—Wisconsin's smaller increase did. The newly settled Dakotah increased its population 131 per cent., and its swine 608 per cent.; Washington, its population 100 and its swine 174 per cent.

In the above table (X.), Tennessee heads the list for 1840, with Kentucky next, and gaining on it in 1850, but leaving it a little in advance. Indiana is first in 1860, with Illinois, Missouri, Tennessee, Kentucky and Ohio not far behind. Illinois is foremost in 1870; Missouri next. So that the great Indian corn region appears, from these returns, to abound most in swine.

XI.

(*h*) *Estimates of maize product, by the Agricultural Division of the United States Patent Office, for the following years :*

STATES, &c.	1842.	1843.	1844.	1847.	1848.
Maine .	1,188,728	1,390 799	1 738 000	2,890,000	3 000 000
N. Hamp.	220,183	330 925	1,662 000	2,280 000	2,600 000
Vermont .	1,391,595	1,252,853	1.440 000	2.100 009	2 500 000
Mass. .	2,202,113	2,347,451	2,816 000	3.410,000	3,800,000
Rhode I.	542 896	578,720	636 000	800.000	900,000
Conn. .	1,827,771	1,926 458	2.408 000	3 180,000	3,400 000
New York	13 311.616	15,574 570	19,468,000	16,000 000	17.500 000
New Jersey	5 000,105	5 805,121	6 966 000	8 000,000	9,000 000
Penn. .	13 553 360	15.857,431	19,029 000	20,200,000	21,000 000
Delaware	2.381,766	2 739 982	3,014,000	3 620.090	3 850 000
Maryland	5.615.640	6.205,282	4,653,000	8 300,000	8 800 000
Virginia	38,101,657	45.836 788	38,960,000	36,500,000	38 000 000
N. Carolina	25,332,194	27,916 077	22.330,000	25,000,000	26 000 000
S. Carolina	16,492,216	18,190 913	13,640,000	12,600 000	13 500 000
Georgia .	24,072 043	26,960 687	22 200 000	25,000 000	27,000.000
Florida .	769,420	838,667	1,100,000	1,000,000	1,250,000
Alabama	26,345,105	24.817,089	22 200,000	26,000,000	28,000.000
Mississippi	7,693,771	9,386,399	2,709,000	16,000,000	17,000,000
Louisiana	7,857,362	8,957,392	7,600,000	9,000,000	10,600,000
Texas .	---------	---------	---------	1,500,000	1,800,000
Arkansas	7,816,255	8,754,204	7,500,000	7,000,000	8,000,000
Tennessee	55,742,384	67,838,477	61 100,000	74,000,000	76,600,000
Kentucky	49,053 849	59,355,156	47,500,000	62,000 000	65,000,000
Ohio .	39,424,221	38,651,128	48,000,000	66,000,000	70,000,000
Michigan	3,703,589	3,592,482	4,300,000	6,500,000	10,000,000
Indiana .	38,838,275	36,677,171	24,500,000	38,000,900	45,000,000
Illinois .	25,546,728	32,760,434	19,680,000	33,000,000	40,000,000
Wisconsin	630,904	750,775	560,000	1,000,000	1,500,000
Iowa	1,788,580	2,128,416	1,690,000	2,900,000	3,500,000
Missouri	25,338,922	27,148,608	12,500,000	25,000,000	28,000.000
Dist. Col.	45,998	47,837	44,000	45,000	50,000
California	---------	---------	---------	---------	---------
Oregon	---------	---------	---------	525,000	1,000,000
Total .	441,829,246	494,618,306	421,953,000	539,350,000	588,150,000

The above estimates for 1842-3-4 seem to have been made up from the reported per centage of increase or decrease of the maize crop in the different States. The summing up of the reports of correspondents, as to the crops for the respective years, are found in U. S. P. O. '42, page 17; in '43, page 52, and in '44, page 67. In 1842 gains were stated in about two thirds of the States. Early cold, dry weather injured the crop in some parts of New Hampshire, and a cold, wet, early summer that of Western New York, and also that of Maryland, eastern shore. Here the army worm, left alive by a warm winter, made matters worse. A wet planting season shortened the crop in Pennsylvania; heavy rains injured it in some parts of Virginia, and drought in others. Great floods swept away whole fields on the seaboard of North Carolina; wet and cold diminished the crop of Ohio; but the other States made the general crop an improvement.

The season of 1843 was not so favorable. Early wet caused late planting in New Hampshire; there was drought in Rhode Island; Alabama was discounted ten per cent.; Ohio suffered from a wet spring and dry summer; Indiana, Illinois and Michigan also, from similar causes; but much new land was planted in Illinois, and the other States raised the total one-sixth above that of the previous year. In 1844 wet weather and floods on the Wabash and Upper Mississippi Valleys so cut down the Western maize crop that the total fell off one seventh. The tabular estimates for 1845-6 have not been found, but the crop of 1845 was pronounced a short one.* In estimating the same crop for 1847, 22 per

*It is stated in the Report for 1845 that the estimate of the maize crop for that year, for the whole country, was 417.900.000 bushels. The crop was an average in Maine; fine in Vermont; an increase of ten per cent. in Pennsylvania; fair in Tennessee, Kentucky, Ohio and Illinois; fell off in New York, from crop of 1844, ten per cent.; twenty in Maryland, and thirty in Virginia. There was drought in South Carolina, and a very small crop in Florida.

cent. was added to the census returns for 1840, being the rate of increase of population during the seven intervening years, and also, according to the political economists, of their productive power. In 1847, after a cold and backward spring, came a most favorable summer, followed by a crop thought to be unexampled in previous years. In 1848 there was a severe drought, especially along the Atlantic coast, which caused great fears for the maize fields; but, just as they were about to wither, came the rains that saved them.

The census returns for 1850, coming so soon after, supplied the Agricultural Reports with tables of maize production for a few years, and the annual tabular estimates were discontinued till 1862; by which time, the Agricultural Department of the United States was fairly established.

In speaking of the maize crop as the natural one for the United States, the report of the Statistician for 1862 remarks that its money value is double that of hay, three-fold that of wheat, and four-fold that of cotton. In the seceding States the increase of the maize crop was much below that of the ratio of population from 1850 to 1860. The former increased 16 4-5 per cent.; the latter 25⅙. This difference was due mainly to the great increase of the cotton product. The increase of the maize crop in these States was chiefly in Arkansas and Texas, which abounded in growers of farm stock. The tobacco crop was also widely extended during that interval in Tennessee and Kentucky.

Some of the States made annual returns or estimates of the maize crop before agriculture became a separate department, for the supervision of the United States Government. Indiana reported in 1854, as raised in that State, 34,811,902 bushels; in 1855, 58,126,259 bushels; in 1856, 39,833,366 bushels; in 1857, 59,793,657 bushels; in 1858, 37,261,622 bushels, and in 1859, 54,045,217—the crop being alternately small and large.

XII.

STATES, ETC.	1862. Bushels.	1863. Bushels.	1864. Bushels	1865. Bushels.
Maine . .	1,855.285	1,855,285	1,410,017	1,692,020
New Hampshire .	1,668,285	1,835,113	1,334,628	1,468,090
Vermont . .	1,585,020	1,743.522	1,585.020	1,796,356
Massachusetts . .	2,465,215	2,465,215	2,280,324	2,363,245
Rhode Island .	458,912	413,021	474.208	497.918
Connecticut . .	2,059,835	2,059.835	2,059,835	2,265,818
New York . .	24,073,257	24,073,257	22,628,862	25,344,325
New Jersey . .	10,023.336	11,025,669	8,464,262	9.733.931
Pennsylvania .	30,721,821	30,721,821	28,381,685	35,477,106
Delaware . .	3,892,337	3,892,337	3,892,337	3,892,337
Maryland . .	14,444,922	14,444,922	10,509,243	14 308,739
Kentucky . .	----------	52,836,997	42,828,706	57,512.833
Ohio . . .	71,792,523	57,433.802	68,202,641	94,119,644
Michigan . .	15,190,137	10,633,097	11,088,801	17.520,305
Indiana . .	92,855,454	54.602.273	74,284,363	116,069,316
Illinois . . .	138,356,135	83 013.68[illegible]	138,356,135	177,095,852
Wisconsin . .	10,087,053	8,069,64[illegible]	10,087,053	13,449,405
Minnesota . .	3,983,426	2,756.898	4,647,329	5,577.795
Iowa . . .	49,340,393	34,538,276	55,261,240	62,997.813
Missouri . .	82,483,232	43,743,295	36,635,011	52,021,715
Kansas . .	6,814,601	8,518,251	4,673,081	6,729.236
Nebraska . .	---------	---------	1,366,622	2,494,084
California . .	478,169	478,169	---------	---------
Total . . .	586,704,474	451,153,378	530,451.403	704,427,853

States not included in the above went out of the Union as Confederate States. In 1866 they were reckoned in again, when the estimated maize product in bushels (the States, &c., designated by their usual abbreviations) was as follows:

Me., . .	1,624,239	Va., . .	24,369,908	Ky., . .	65,564,630
N. H., . .	1,321 281	N. C., . .	21,656,566	Ohio, . .	99,766,822
Vt., . .	1,490,975	S. C., . .	6,026,242	Mich., . .	16,118,680
Mass., . .	2,363,245	Ga., . . .	15,695,909	Ind., . .	127,676,247
R. I., . .	408,293	Fla., . .	1,984,073	Ill., . .	155 844,350
Conn., . .	2,220,502	Ala., . .	21,597,083	Wis. . .	9,414,583
N. Y., .	22,809,893	Miss'pi., .	11,913,650	Iowa, . .	52,288,184
N. J., . .	9,539,223	La., . .	6,910,035	Mo., . .	46,819,543
Pa., . .	35,831,877	Texas, . .	20,295,863	Ks., . .	6,527.358
Del., . .	4,281,570	Ark., . .	11,585,332	Neb., . .	2,095,030
Md., , .	15,024,176	Tenn., . .	46,880,933	Total .	867,946,295

The method of the Department, in making these and other estimates, is explained in U. S. A. R., 1863. Monthly in summer and bi-monthly in winter, the Department issued circulars to its correspondents (recommended by members of Congress and others, and paid for their services only in copies of the annual and monthly reports, seeds, &c.); their number intended to be not exceeding one for an ordinary sized county of four hundred square miles, and five assistants. It was found that their information was best given as a tenth or more of the crop in question, greater or less than the preceding one. Their returns, on a day named in the circular, were sent to the Department by mail, and as fast as received entered on the rolls of each State; when all entered, added up, and the sum divided by the number of counties returned for each crop. This gave the general average of each State in tenths and fractions of a tenth. From this, the average product of the crop in bushels, or pounds, was calculated, chiefly on the basis of the census returns of 1840, '50 and '60, and taking into view the general progress of agriculture in each State for a series of years, and ascertaining the per cent. of increase "of the progress made by each State, in each crop, at different periods of this progress;" also examining the special causes acting on production, as railways or other improvements in transportation, or on prices, as an unusual commercial demand; or in the change of products by the growth of manufactures. The duration, extent and intensity of their action were considered. At that time the Government supplies were taken into account. How far each section of the country would be influenced was to be judged of "from personal knowledge of the general agricultural condition of the country, and of much of its local peculiarities." The National and State census were to be compared, "and from every source of information" were to be derived the means

of correcting the returns of correspondents. It was claimed that, "when once the plan was fairly in operation, the annually published estimates of the production of the counties" would be a sufficient guide for the correspondents, especially when made skillful by longer experience. It was also claimed that, in spite of the troubles of the time, the returns of correspondents were "far more reliable than most of those made by township and county assessors, who collect agricultural statistics for the several States;" and that most of the statements made of the amounts of crops and of farm stock had been tested by time and commercial transactions, and "sustained in a most gratifying manner." It is further stated, in the 1862 report, that, as no circulars were sent to California, on account of its remoteness, estimates of its products were based on its State statistics of crops for 1861 and their prices in San Francisco; and, as Ohio had a much more perfect system of taking its agricultural statistics, its returns had been chiefly relied on, but not entirely. When the amount of the crop was determined, the acreage and total value were deduced from that by a simple arithmetical calculation; the prices and yield per acre being familiar to all farmers, having been obtained through the circulars. The report of the statistician in 1864 illustrates the method of returns in tenths somewhat more fully, and adds that each year's crop would be estimated from such returns, "on the basis of the amount of the crop of the preceding year."

The crop for 1862 was characterized in the report for that year as the "best ever grown." That of 1863 was shortened more than one hundred and thirty-five million bushels by destructive frosts. The crop of 1864 was much better, but that of 1865 gained on this 33 per cent; Illinois still in front; next, successively, Indiana, Ohio and Iowa. That of 1866 was abundant, except in some of the Southern States—there was more than an average in Texas.

ESTIMATES OF MAIZE CROPS, FROM U. S. A. DEPARTMENT.

STATES.	PLANTED IN THE YEARS				TOTAL VALUE OF CROP IN				BUSHELS, PER ACRE.				AVERAGE PRICE.			
	1862. acres.	1863. acres.	1864. acres.	1865. acres	1862. dollars.	1863. dollars.	1864. dollars.	1865. dollars	'62. bush	'63. bush	'64. bush	'65. bush	'62. cts.	'63. cts.	'64. cts.	'65. cts.
Maine	54,567	59,848	52.223	49,765	1,743,968	2 170 683	2.961,036	2,037,344	34	31	27	34	94	117	2'0	121
N. H.	43,902	61.170	45 212	44,487	1,518,139	2.146.482	2,816,065	1 782.729	38	30	29½	33	91	117	211	121⅓
Vt.	45,286	52 834	40 851	40,826	1,378,967	2 022.486	3,106,639	2 070,300	35	33	38 8	43¾	87	116	196	115¼
Mass.	66,627	74,703	72,319	70,897	2.095.463	2,958,258	4,651.861	2,611,385	37	33	31½	33⅓	85	120	204	110⅓
R. I.	12,403	11,801	15,676	15,809	385.486	483,235	991.095	609,949	37	35	30¼	31½	84	117	209	122⅓
Conn.	64,370	62,419	66,446	73,091	1,730,261	2.471 802	3,728,301	2,775,627	32	33	31	31¼	84	120	181	122½
N. Y.	687,807	729 492	771.526	1,056,013½	15,888 350	24.073.257	38,016,488	24.077,109	35	33	29⅓	24	66	100	168	95
N. J.	270,901	324,284	267.349	229,147	6,815,978	11,025,669	14,401,337	8,322,485	37	34	31⅔	42⅓	68	100	1701-7	85½
Penn	853.384	930,964	962,091	886 928	17.204,220	28.878,512	43,920.658	28 838,168	36	33	29½	40	56	94	154¾	80
Dela.	194,617	155.693	191,458	235,596	2.024,015	3,892 337	6,033 122	2.919,253	20	25	20⅓	16½	52	100	155	75
Md.	515,890	628,040	488,80[illegible]	475.373⅓	8,955,852	13 144,879	17 024,974	10,888,950	28	23	21½	31, 1	62	91	162	76,1
Ky.	..	1,553,999	1,502.761	1,691,554	....	33,550,818	41,399,749	24.922.247	...	34	28½	34	...	63½	96⅔	43⅓
Ohio	2,175 531	2,393 075	2,176,911	2,267 943	31,588,710	42 501,013	65.474.535	41,816,012	33	24	31⅓	41½	44	74	96	44, 4
Mich	370,491	379,753	455,76[illegible]	455.073	6.379 858	7,868,492	13 971,889	10,706,850	41	28	24⅓	38½	42	74	126	60, 1
Ind.	2,210 847	2.275,095	2,561.529	2.873,000	26 928 082	37,129,545	70.941,567	44,918.823	42	24	29	40, 4	29	68	95½	38, 7
Ill.	3,458,903	3,773,349	4.192,610	5,023 996	32,821,911	51.479,442	103.767,101	51,800,536	40	22	33	35¼	23	62	75	29¼
Wis.	252.176	298,876	325 388	324,084	4,034,821	5,083.874	9,481.829	6,209,726	40	27	31	41½	40	63	94	46
Minn.	88,521	119 865	140,828	146,784	1.513,901	1.681,708	4.368.485	2,872.564	45	23	33	38	38	61	94	51½
Iowa	1.298.431	1,279 194	1,507,124	1 478,822	9.374 675	13,815.310	37,370,414	18,899.344	38	27	36⅔	42, 6	79	40	67⅝	30
Mo.	2.170,611	1.508.389	1,366,978	1,333,890	21,445,640	22.746,513	35,535.961	27,051.292	38	29	26 8	39	26	52	97	52
Kansas	170,365	193,597	186 923	163,463	2,180,672	2.555,475	6,402,121	3,566,495	40	44	25	41, 1	32	30	137	53
Neb.	....	....	47,951	53,636	....	....	1,352,956	4,471,510	...	...	28½	46½	...	...	99	59
Cal.	17.339	.. ..	....	.. ..	525.985	. ...	....	....	28	...	..	....	1,10	...	...	.. ..
Total	15 022,74[illegible]	[illegible]6.866.440	17,438,752	18,990,180	19[illegible] 534.934	311,669.790	527.718.183	324.168,698	*37.3	*25,9		*25	34,8	69.9	.	....

* General average for United States.

The acreage of maize is of three kinds—that of new land, of land undergoing a rotation, and of land successively in this crop. The last is only consistent with good farming in the case of very rich and deep soil, or of harvesting by hogging down, or of very heavy manuring. The second indicates a better system, which, if the rotation is suited to the soil and climate, is a very safe one. If the first kind, the inquiry follows, whether the newly planted is an addition to the body of well improved land, or whether it is after the style of the old Virginia tobacco lands, a substitution of virgin soil for that which is exhausted. It is very important that the truth of the matter should be known as to the nature of this acreage; for the exhaustion of the soil of the country for the sake of a temporary profit, is really selling its birthright for a mess of pottage. The business of every farmer is to provide "meat for the hungry," and he has a duty to perform for the great future, as well as for the present, in view of the hundred million who are destined to occupy the homesteads of the Great Republic. He should do his part, in leaving a patrimony, instead of a waste, to those who follow him in the possession of the "land of the free."

As these three kinds of acreage are thrown together in the estimates, in order to ascertain how well a farming community has performed this duty, it is necessary to consider, not only such specialties as the yield per acre, but various circumstances connected with the general farming interest. As the opening up of the land is of itself a benefit, and the beginner on a new plantation very frequently has his land to pay for, and is not over-stocked with capital, such temporary expedients as "listing," more or less practiced in pioneering, may not work permanent injury, provided the farmer takes up better methods as soon as his means will justify him in doing so. But in older settlements that kind of scratching of the soil is not to be thought of. In the States

where maize culture has attained a permanent standing, especially where land is in the possession of actual farmers, the yield per acre, for a succession of years, is a good indication of its progress. In the New England States, the political embarrassments of the country, during the years 1862–5, inclusive, would naturally make Western freights more costly, and it would be, in many cases, for the interest of the farmer to put more acres in Indian corn; and this, not only to supply the home demand, but that for exportation, which was very large in 1862-3. The yield per acre in these States was very good in 1862, averaging 35½ bushels. The extraordinary export of 1862 seems to have stimulated production in 1863, for the acreage of maize increased 12 per cent.; and, in spite of the heavy frosts, which are said to have shortened the crop for the whole country, the average yield per acre in these six States increased to 37½ bushels. There was a like increase of acreage in New York, New Jersey, Pennsylvania and Maryland, but the average yield per acre therein decreased from 34 to 31 bushels. The acreage was considerably increased in the Western States—except Missouri, where it fell off nearly one-third; but the yield per acre was considerably less in each, except in Kansas, where it rose to 43 bushels. But as the yield had been above an average in these States in 1862, much of it must have found its way into New England in 1863; and as the average price in the latter was estimated at $1 19½, and in the former about 57c., there would be a large margin to pay for transport to the New England markets and places of foreign export. This competition seems to have brought down Eastern acreage in Indian corn in 1864—that of the New England States being reduced 9 per cent., and New Jersey and Maryland 17½ and 22 per cent, respectively; although Pennsylvania and New York increased slightly, and Delaware 23 per cent. The Western

States gained still more in acreage in 1864—except Missouri, which fell off nearly a tenth, and Ohio and Kansas, where it was slightly diminished—the yield per acre improving considerably, except in Michigan, Missouri and Kansas. This discussion might be extended indefinitely.

As to the prices, the effect of the publication of Agricultural Department estimates is shown in 1863, by the increase of 20 cents in the market, resulting from the statement in the monthly report for October, that the maize crop for that year was lessened 135,000,000 by the distractions of the country and the destructiveness of the frosts. A decrease in the number and weight of hogs was also shown by the report, which was corroborated by subsequent returns from the packing-houses—the law ot supply and demand in this case giving the farmer his due.

The most noticeable feature of the war prices of Indian corn was their inflation, corresponding, somewhat, with that of the gold premium. On the 13th of December, 1861, that premium was quoted at less than 1 per cent.; but in the same month the New York banks stopped specie payments. On the 2d of January, 1862, the premium on gold was 12c., that is, the price in currency of a gold dollar was $1.12. It remained nearly the same till June 18, when it rose to 115, and on July 2d,* to 119, and on October 23d, to 132. It will be seen that the average price for Indian corn for '62 was estimated in the table at 66 cents for New York State, and, in 1863, at $1 per bushel; and on 16th of October, '63, gold was 153. That the advance in corn was much greater than that in gold, was probably due to the fact that the crop was much smaller in '63 than it was in '62. It was fair in '64, and the estimated price of New York, for same year, was $1 68 per bushel. On the 30th of July, '64, the price of gold was $2.56; having been $2.75 on 9th July.

* See U. S. A. R., 1863.

XIV.

Estimated Products of Maize, from U. S. A. Reports, in Bushels, expressed in Thousands (three last figures, being ciphers, omitted) in the following years :

STATES, &C.	1867. Thous	1868. Thous	1869. Thous	1870. Thous	1871. Thous	1872. Thous	1873. Thous	1874. Thous
Maine . .	1,575	1,590	1,450	1,198	1,078	1,218	852	809
New Hampshire .	1,413	1,511	1,400	1,213	1,273	1,374	1,305	1,239
Vermont . .	1,520	1,672	1,475	1,920	1,747	1,921	1,748	1,660
Massachusetts .	2,363	2,292	1,950	1,327	1,419	1,461	1,446	1,431
Rhode Island .	340	475	440	280	308	295	297	279
Connecticut .	2,242	2,152	1,950	1,413	1,624	1,705	1,534	1,687
New York .	19,500	20,910	19,100	19,426	17,483	19,231	17,692	16,807
New Jersey . .	9,730	10,216	9,200	10,057	10,559	12,142	10,442	9,397
Pennsylvania.	30.457	31,979	29,500	38,866	39,254	43.964	36,929	35,821
Delaware . .	3,639	3,275	3,200	3,311	3,575	3,289	2,960	2,841
Maryland .	11,650	12,349	12,300	11,818	11,227	11,602	10,451	10,032
Virginia . .	18,490	19,969	17,500	19,360	19,553	18,184	19,275	19,082
North Carolina	17,974	23,366	17,400	22,500	20,700	24,012	21,130	22,186
South Carolina .	7.834	9 870	8,100	12.000	9.840	10.627	9,245	10,169
Georgia . .	29.037	27,294	27,500	31,000	20.150	23,777	24,014	24,494
Florida . .	2,500	2,950	3,100	2,247	2,022	1,920	2,112	2,112
Alabama .	35.500	31.240	30,200	35,334	19,080	22,896	21,751	20.228
Mississippi . .	19,657	35.519	30,000	30,300	18,180	21.816	18.543	18,357
Louisiana .	9,535	17,397	16,850	18,000	8,100	10 125	9,112	7,836
Texas . . .	20,716	21,337	23,000	23,690	20,847	27,934	23,743	28 016
Arkansas .	21,243	32,449	25,750	25,000	16,250	17,062	16,208	9,724
Tennessee . .	50,250	54.772	47,500	51,000	45.900	46,818	42,604	31.953
West Virginia .	6,500	7,695	8,100	9,837	9.345	9,905	10,004	8,803
Kentucky . .	46,550	58,187	51,500	63,345	53,843	63,534	58,451	48,514
Ohio . .	64,000	74,040	68,250	87,751	89,506	99,351	88.422	88,422
Michigan . .	15.118	18.815	14,100	19,035	16,179	16,987	14,099	12,689
Indiana . .	80,757	90,832	73,000	113,150	79,205	85 541	67,840	74,624
Illinois . .	109.091	134,363	121,500	201,378	203,391	217,628	143,634	133,579
Wisconsin .	9.885	12,565	9,500	19,995	21,394	21,180	16,308	15,492
Minnesota , .	4.500	8,255	5,750	5.823	8,152	7,988	7,189	7,548
Iowa . .	53.333	35,332	78,500	93,415	99,019	101 989	105.200	115,720
Missouri . .	50,437	60,9[illegible]7	80,500	94,990	87.390	105,741	70,846	46.049
Kansas . .	8,159	6,487	24,500	16,685	24,693	29,631	47.000	16.065
Nebraska . .	2,325	3,185	6,750	5,163	7,228	7,589	7,000	3.500
California .	....	1,220	1,305	1,099	934	1,400	1,540	1,617
Pacific States .	500	....	....	....	....	....	....	....
Oregon . .	....	....	200	88	85	89	94	94
Nevada . .	....	....	....	11	12	13	12	12½
Nevada, Territories	....	....	2,000	....	....	....	....	....
Territories . .	....	....	....	1,230	1 353	1,380	1.242	1,260
Total . .	768,320	906.527	874,320	1,094.255	991,898	1,092,719	932,274	850 148 ½

Beginning with 1866, in a previous table, the totals seem to be the highest in the even years, with a tendency upward, till 1872. The falling off in 1874 was doubtless owing, in part, to ravages of the grasshoppers that year in some of the Trans Mississippi States. The totals for the odd years are from 32,000,000 to 160,000,000 bushels smaller than for the even ones immediately preceding.

XV.

ESTIMATED ACRES IN CORN IN FOLLOWING YEARS—FULL FIGURES:

STATES.	1866.	1867.	1868.	1869.	1870.	1871.	1872	1873.	1874.
Maine	49,219	47,155	53,355	59,670	36,303	39,632	36,358	35,000	32,886
New Hampshire	41,290	39,802	43,171	46,666	33,232	35,658	35,968	34,800	34,038
Vermont	44,474	41,988	43,428	43,382	48,484	49,073	49,256	56,387	45,983
Massachusetts	69,507	66,190	61,945	57,017	40,212	41,370	42,976	41,314	44,719
Rhode Island	14,956	13,229	17,592	17,460	10,769	11,282	9,833	10,348	11,481
Connecticut	67,288	67,939	63,294	62,500	53,522	51,719	54,647	51,133	56,233
New York	844,811	641,447	653,437	704,797	571,352	529,787	512,826	570,710	560,233
New Jersey	220,305	293,957	272,426	298,701	304,757	293,305	307,392	290,055	268,486
Pennsylvania	1,011,624	951,781	913,685	939,490	1,085,642	1,105,746	1,127,282	1,052,108	1,078,946
Delaware	267,598	223,251	131,000	177,777	132,440	162,500	164,450	155,789	157,833
Maryland	500,806	410,211	445,812	608,910	525,244	475,720	478,347	488,364	489,366
Virginia	1,218,495	884,689	1,034,663	1,129,032	968,000	865,176	865,904	1,014,474	954,100
North Carolina	1,804,714	1,549,482	1,633,986	1,175,675	1,541,095	1,478,571	1,500,750	1,488,028	1,352,805
South Carolina	1,021,397	816,041	967,647	698,275	1,348,314	984,000	1,012,095	973,158	924,454
Georgia	2,531,598	2,216,564	2,149,133	2,500,000	2,296,296	1,956,310	1,902,160	1,952,358	2,206,667
Florida	150,308	211,864	280,952	276,785	208,055	188,971	200,000	203,077	199,245
Alabama	2,399,676	2,191,358	2,892,592	2,013,333	2,019,085	1,315,862	1,300,909	1,500,069	1,644,553
Mississippi	821,631	1,252,038	2,077,134	1,714,285	1,836,363	1,298,571	1,246,628	1,196,322	1,330,217
Louisiana	406,473	611,217	790,772	674,000	800,000	562,500	547,297	552,242	505,548
Texas	780,610	734,609	853,480	793,103	893,962	1,097,210	1,104,110	1,249,631	1,474,526
Arkansas	482,722	801,622	1,063,901	919,642	786,163	608,614	726,042	689,702	771,746
Tennessee	2,130,951	2,120,253	2,164,901	2,375,000	1,976,744	1,995,652	1,992,255	1,893,511	1,901,964
West Virginia	....	218,855	219,857	291,366	323,585	338,586	347,543	344,965	332,189
Kentucky	2,061,781	1,884,615	1,779,418	2,060,000	1,973,364	1,972,271	2,036,346	1,981,390	1,940,560
Ohio	2,625,143	2,229,965	2,177,647	2,267,441	2,259,325	2,324,831	2,515,215	2,526,343	2,456,167
Michigan	503,709	481,464	570,151	487,889	514,459	499,351	471,861	454,806	469,963
Indiana	3,497,980	2,765,650	2,671,529	3,146,551	2,864,556	2,218,627	2,210,361	2,650,000	2,763,852
Illinois	4,931,783	4,583,655	3,928,742	5,237,068	5,720,965	5,310,469	5,468,040	6,839,714	7,421,055
Wisconsin	332,671	294,196	380,757	359,848	526,184	567,480	557,368	543,600	549,362
Minnesota	....	150,000	246,417	197,594	176,454	218,552	226,931	228,222	243,484
Iowa	1,659,942	1,577,899	1,765,729	2,364,457	2,919,218	2,329,858	2,562,537	3,627,586	3,963,014
Missouri	1,520,115	1,854,301	2,012,112	2,630,718	3,025,159	2,299,736	2,857,864	3,014,723	2,878,062
Kansas	190,858	211,373	360,388	506,198	595,892	617,325	769,636	1,202,046	1,530,000
Nebraska	71,503	64,583	139,082	159,952	172,675	174,168	200,767	200,000	350,000
Pacific States and Territories	....	17,006	....	....	....	....	....	....	....
California	....	....	27,111	31,521	30,870	24,578	40,000	37,561	44,668
Oregon	....	....	....	5,714	2,962	3,195	3,178	3,133	3,082
Nevada	....	....	....	....	314	375	393	400	431
Territories	....	....	....	71,428	34,261	44,506	41,317	43,579	45,000
Totals	34,306,538	32,526,249	34,887,246	37,103,245	38,646,977	34,091,137	35,526,836	39,197,148	41,036,918

In 1867, only Maine, New Hampshire and twenty other States planted fewer acres in corn. The large crop provided for was cut down by a spring unfavorable for rapid and healthy growth, and by summer drought in the Ohio Valley; in many places one-half; Illinois yielding but 23.8 bushels per acre. The large yield per acre in New England is due to careful culture and skillful manuring. Fertilizers of various kinds are used liberally there in this crop. The wet spring of 1867 kept back seasonable plowing, and farm help was scarce; cold rains were the cause of slow growth. In 1868 the acreage increased more than two millions; a large part of the advance being in the Southern States. "The high temperature of July was favorable to the growth of corn, and the prospect was good for a thousand millions until August, when unseasonably cool and, in some localities, wet weather, set in, followed by early frosts. The result was a sudden and injurious check at the critical period of earing, resulting in late ripening, smut, and other evidences of abnormal conditions." Southern Indiana and Ohio, West Virginia and Pennsylvania suffered from heavy rains, and Iowa and North Indiana and Illinois from early frosts.

In 1869 the area of maize culture was very much extended, which the frequent spring showers made it difficult planting. Mid-summer was more propitious, but cold nights retarded its growth in the Northern States, and a severe drought pinched it in the Atlantic States of the South, and, though it escaped material injury from late frosts, the crop was thought to be one hundred and fifty millions short of a good return—which was reckoned at one thousand million bushels.

In 1870 the early conditions of growth were favorable. Wet weather in the Carolinas made it difficult to kill the weeds. Notwithstanding some injuries from drought, wet weather, worms and early frosts, almost every State, by

September, made returns of high condition, and October made it clear that the crop would be larger than those of the two preceding years, and probably the best for a decade. It ripened unusually early; some was injured by drought and cut up for fodder, and some, in the valleys of Virginia, ruined by floods, and small portions in the South damaged by excessive rains; but the bulk of the crop was remarkably sound.

In 1871 the central corn region of the West had an early planting and the growth was rapid, except where the cut-worm was rooted in the sod land, or local drought prevailed, or cold rains fell on low-lying lands of dense clay, undrained, or otherwise unameliorated. Cut-worms were more destructive in the Eastern and Middle States than in the West. Southern corn had a good start, but soon felt the cold rains. The nights in June were "too cool for corn in New England and through the Alleghany elevations as far south as Virginia." Imperfect cultivation was the result of heavy rains in the South. In some places, where the crop was in good condition till mid July, a severe drought set in. The crops were lighter in the South-west, although the acreage was diminished there, except in Tennessee and Texas. In the latter State, especially, there was much loss from drought.

In 1872 the acreage was increased about three per cent. The season was not very propitious during May and June, and the returns of 1st July showed the condition of corn planted in 413 counties below average; in 263 above average, and in 313 average. But the showers and sunshine of July greatly advanced the crop in all the States, except some of those on the Atlantic, south of the Potomac, and a few in high latitudes. The growth in August was rapid, and the result was one of the largest crops ever grown.

XVI.

ESTIMATES OF MAIZE FOR U. S., BY AG'L DEP'T, FOR THE FOLLOWING YEARS:

STATES, &C.	Average yield per acre in bushels. '66	'67	'68	'69	'70	'71	'72	'73	'74	Average price per bushel, in dollars and cts. '66	'67	'68	'69	'70	'71	'72	'73	'74
Maine	33	33.4	29.8	24.3	33	27.2	33.5	24	24.6	1.35	1.59	1.38	1.27	1.14	98	94	91	1.13
New Hampshire	32	35.5	35	30	36.5	35.7	38.2	37.5	36.4	1.37	1.56	1.43	1.30	1.09	95	95	92	1.12
Vermont	33.3	36.2	38.5	34	39.6	35.6	39	31	36.1	1.41	1.52	1.34	1.40	1.10	99	84	85	1.10
Massachusetts	34	35.7	37	34.2	33	34.3	34	35	32	1.34	1.53	1.32	1.32	98	98	90	84	1.10
Rhode Island	27.3	25.7	27	25.2	26	27.3	30	28.7	24.3	1.42	1.64	1.65	1.28	1.06	99	90	92	1.18
Connecticut	33	33	34	31.2	26.4	31.4	31.2	30	30	1.26	1.50	1.35	1.30	1.14	1.07	92	94	1.17
New York	27	30.4	32	27.1	34	33	37.5	31	30	1.16	1.32	1.12	1.03	87	82	70	70	93
New Jersey	43.3	33.1	37.5	30.8	33	36	39.5	36	35	1.03	1.23	99	95	81	75	62	62	82
Pennsylvania	34.4	32	35	31.4	35.8	35.5	39	35.1	33.2	91	1.17	1.00	92	75	77	60	60	76
Delaware	16	16.3	25	18	25	22	20	19	18	87	1.02	85	70	65	60	55	53	70
Maryland	30	28.4	27.7	20.2	22.5	23.6	23	21.4	20.5	93	1.09	87	73	71	64	57	68	73
Virginia	20	20.9	19.3	15.5	20	22.6	21	19	20	73	85	76	91	65	67	58	59	64
North Carolina	12	11.6	14.3	14.8	14.6	14	16	14.2	16.4	1.12	1.04	78	1.00	78	71	62	64	72
South Carolina	5.9	9.6	10.2	11.6	8.9	10	10.5	9.5	11	1.58	1.15	1.00	1.40	1.06	92	96	94	1.00
Georgia	6.2	13.1	12.7	11	13.5	10.3	12.5	12.3	11.1	1.52	96	91	1.21	90	93	86	82	92
Florida	13.2	11.8	10.5	11.2	10.8	10.7	9.6	10.4	10.6	1.50	1.38	1.41	1.45	1.35	1.09	1.20	1.11	99
Alabama	9	16.2	10.8	15	17.5	14.5	17.6	14.5	12.3	1.51	79	86	1.14	93	92	78	84	93
Mississippi	14.5	15.7	17.1	17.5	16.5	14	17.5	15.5	13.8	1.57	1.09	74	1.12	98	98	88	85	1.01
Louisiana	17	15.6	22	25	22.5	14.4	18.5	16.5	15.5	1.23	1.10	75	1.09	1.10	1.12	88	90	1.00
Texas	26	28.2	25	29	26.5	19	25.3	19	19	94	75	62	73	1.06	1.11	43	80	75
Arkansas	24	26.5	30.5	28	31.8	26.7	23.5	23.5	12.6	1.14	77	63	92	80	66	73	80	95
Tennessee	22	23.7	25.3	20	25.8	23	23.5	22.5	16.8	77	55	49	77	47	51	48	58	68
West Virginia	....	29.7	35	27.8	30.4	27.6	28.5	29	26.5	....	89	75	79	64	63	55	54	61
Kentucky	31.8	24.7	32.7	25	32.1	27.3	31.2	29.5	25	49	65	47	66	48	47	37	44	55
Ohio	38	28.7	34	30.1	39	38.5	39.5	35	36	54	82	60	72	48	45	34	42	58
Michigan	32	31.4	33	28.9	37	32.4	36	31	27	82	96	76	74	55	59	43	47	65
Indiana	36.5	29.2	34	23.2	39.5	35.7	38.7	25.6	27	44	65	52	70	38	37	29	40	51
Illinois	31.6	23.8	34.2	23.2	35.2	38.3	39.8	21	18	43	68	43	57	35	32	24	32	56
Wisconsin	28.3	33.6	33	26.4	38	37.7	38	30	28.2	82	86	58	65	52	43	40	44	63
Minnesota	....	30	33.5	29.1	33	37.3	35.2	31.5	31	...	1.07	64	63	51	44	36	41	51
Iowa	31.5	33.8	37	33.2	32	42.5	39.8	29	29.2	44	55	37	50	34	23	18	31	43
Missouri	30.8	27.2	30.3	30.6	31.4	38	37	23.5	16	58	66	57	60	44	31	32	38	74
Kansas	34.2	38.6	18	48.4	28	40	38.5	39.1	10.5	63	55	99	44	58	29	22	31	91
Nebraska	29.3	36	22.9	42.2	29.9	41.5	37.8	35	10	68	74	69	37	36	25	18	28	73
California	....	....	45	41.4	35.6	38	35	41	36.2	....	...	1.00	90	1.20	1.16	1.00	73	98
Oregon	....	....	....	35	29.7	26.6	28	30	30.5	...	90	...	80	1.00	1.00	93	60	94
Nevada	....	....	....	28	35	32	33	30	29	....	....	....	...	1.25	1.50	1.50	1.60	1.50
Territories	....	29.4	....	....	35.9	30.4	33.4	28.5	28	...	90	...	1.10	99	97	86	97	1.00
Average for United States	25	23	25.9	23.5	28.3	29.1	30.7	23.8	20.7	...	.	...	75.3	54.9	48.2	39.8	48	64.7

XVII.

ESTIMATED VALUE OF MAIZE CROPS IN THE UNITED STATES, AS REPORTED BY THE DEPARTMENT OF AGRICULTURE, IN DOLLARS, FOR THE FOLLOWING YEARS:

STATES, &c.	1866	1867	1868	1869	1870	1871	1872	1873	1874
Maine	2 192,723	2,504,250	2,194,200	1,841 500	1,365,720	1,056 440	1,444 920	775,320	914,170
New Hampshire	1,810,155	2,204 280	2,160,730	1,820,000	1,322 170	1,209 350	1,305,300	1 200,600	1,387 680
Vermont	2,102,275	2,310,400	2,240,480	2,065 000	2,112 000	1 729 530	1,613,640	1,485 800	1,826 000
Massachusetts	3,166,748	3 615,390	3,025,440	2,574,000	1,300,460	1,390,620	1,314,900	1,214 640	1,574 100
Rhode Island	579,776	557,600	783,750	563,200	296,800	304,920	265,500	273,240	329,220
Connecticut	2,797,832	3,363,000	2,905,200	2 535,000	1,610,820	1 737,680	1,568,600	1,441 960	1,973 790
New York	26,459,475	25,740 000	23,419,200	19,673,000	16,900,620	14 336 060	13,461,700	12,384,400	15 630,510
New Jersey	9,825,400	11,967,900	10,113,840	8,740,000	8,146,170	7,919,250	7,528,040	6,474 040	7,705,540
Pennsylvania	32 607,008	35,634,690	31,979,000	27,140,000	29,149 500	30,225,580	26,378,400	22,157,400	27,223,960
Delaware	3,724,966	3,711,780	2 783,750	2 240 000	2,152 150	2,145,000	1,808,950	1,568,800	1,988,700
Maryland	13,972 483	12 698,500	10,743,630	8,979,000	8,390,780	7 185,280	6,271,140	7,106,680	7,323,360
Virginia	17,790,033	15,716 500	15 176,440	15,925,000	12,584,000	13,100,510	10,546,720	11,372,250	12,212,480
North Carolina	24,255,354	18 692 960	18,225,480	17,400,000	17 550,000	14 697 000	14,887,440	13,523,200	15 973 920
South Carolina	9,521,462	9 009,100	9,876,000	11,340,000	12,720,000	9,052,800	10,201,920	8,690,300	10 169,000
Georgia	23,857,782	27,875,520	24,837,540	33,275 000	27 900,000	18 739,500	20,448,220	19,691,480	22,534 480
Florida	2,976,110	3,450 000	4 159 500	4 495 000	3 033,450	2,203,980	2,304,000	2,344,320	2 090,880
Alabama	32,611,595	28 045,000	26,866,400	34,428,000	32,860 620	17,553,600	17,858,880	18,270,840	18,812,040
Mississippi	18,704,430	21,426,130	26,284,060	33 600,000	29,694 000	17,816,400	19,198,000	15,761,550	18 540,570
Louisiana	8,499,343	10,488,500	13,047,750	18,366,500	19,800,000	9,072,000	8,910,000	8,200,800	7 836 000
Texas	19 078,111	15,537,000	13,228,940	16,790,000	25,111 400	23,140,170	12 011,620	18,994,400	21,012,000
Arkansas	13 207,278	16,357,110	20,442,870	23,690,000	20,000,000	10,725,000	12,455,260	12 966,400	9,237,800
Tennessee	36,098,318	27,637,500	26,838,280	36 575,090	23,970,000	23 409,000	22 472,640	24 710 320	21,728 040
West Virginia	....	5,785 000	5,771,250	6,399,000	6,295,680	5,887,350	5,447,750	5,402,160	5 369,830
Kentucky	32,126 669	30,257,500	27,347,890	33,990,000	30,405 600	25,306,210	23 507,580	25,718,440	26 682,700
Ohio	53 874,084	52,480 000	44,424,000	49 140,000	42,120,480	40,277,700	33,779 340	37,137,240	51,284,760
Michigan	13,217,318	14,513,280	14,299 400	10,434,000	10 469,250	9,545,610	7,304,410	6 626,530	8,247,850
Indiana	56,177,548	52,492 000	47,232,640	51,100,000	42,997,000	29,305,850	24,806,890	27,136,000	38 058,240
Illinois	67,013,070	74 281,880	57,776,090	69,255,000	70,482,300	65,085,120	52,230,720	45 962,880	74,804 240
Wisconsin	7,719,958	8,501,100	7,287,700	6,175,000	10,397,400	9,199 420	8,472 000	7,175,520	9 759,960
Minnesota	....	4,815 000	5 283,200	3,622,500	2,969,730	3,586,880	2,875 680	2,947,490	3,849,480
Iowa	23,006,801	29,333 150	24,172,840	39,250,000	31,761,100	22,774,370	18,358,020	32 612,000	49 759,600
Missouri	27 155,335	33,288 420	34,751,190	48,300 000	41,795,600	27,090 900	33,837,120	26,921,480	34,076,260
Kansas	4,112,235	4,487,450	6 422,130	10,780 000	9 677,300	7,160,970	6,518,820	14,570,000	14 619,150
Nebraska	1,424,620	1,720 500	2,197,650	2,497,500	1,858,680	1,807,000	1,366,020	1,960,000	2,555,000
California	....	*450,000	1,220,000	1,174,500	1,318 000	1,083,440	1,400,000	1,124,200	1 584,660
Oregon	....	....	....	*160 000	88,000	85,000	82,770	56,400	88,360
Nevada	....	....	....	†2,200,000	†13,750	18 000	19,500	19,200	18,750
Territories	......	....	....	....	1,217,700	1,312 410	1 186 800	1 204,740	1,260,000
Totals	591,666,295	610,948,390	569,512,460	658,532,700	601,839,030	478,275,900	435,149,290	447,183,020	550,043,080

Tables are given in the reports of the U. S. Agricultural Department of the average value for each State of an acre planted in Indian corn. This does not always express the profit of the crop. Nature has already highly manured the cheaper, because newly settled acres of the West, and, with a sufficient team, and the right implement to turn up the sod of the prairie, and other implements to make the cultivation thorough and rapid, the farmer can, in a favorable season, realize large crops very cheaply; but these crops are ordinarily cheap in his home market. The Eastern farmer gets better prices, because he is nearer the great markets, and because his home market is greatly improved by division of labor; but his soil and climate are less favorable, and his out-lay for manure and labor must be considerable. The interest on the value of his land is greater. The Western farmer may gain on him by feeding his corn to swine. The average value of an acre in corn for four years, ending 1865, in Vermont, was $48.80; in Iowa, $19.59, giving a large margin for shipment East. The yield per acre of Vermont and Iowa for that year was nearly equal.* Ohio, a much older State than Iowa, and very much younger than Vermont, with two or three less bushels of yield, has an average value per acre in corn, for the same years, of $20.20. With regard to the estimates of prices in the different States for 1862, it is said, in explanation of the fact, that the prices in the States so near the great markets, as Rhode Island and New Jersey, are so different, that what Rhode Island is to the Boston market in locality, New Jersey is to the New York market; yet there is a much greater difference in their market prices than exists in these cities, owing to the difference in their industries, Rhode Island being chiefly a manufacturing and New Jersey an agricultural State; the "one re-

* See U. S. Agricultural Report for 1865.

ceives and the other supplies; and hence the difference in prices should represent the cost of transportation between them." The different prices in Ohio and Indiana are also referred to, as showing the principles on which the estimates are made. Although the market facilities of Indiana are nearly equal with those of its neighbor, Ohio, in many respects, the former was, in 1862, the largest swine producing State, and this stock consumed most of its corn; and so its estimated price represented the value of corn fed to hogs. But in Ohio large quantities of maize were consumed by distillers and considerable shipped Eastward; and so the price of this crop "exhibits its value when hauled to the nearest railroad depot."

There is some difficulty in appreciating so large a quantity as eleven hundred million bushels of corn. Perhaps some idea of its vastness may be gained from the following statements: Suppose a train of carts, each drawn by one yoke of oxen, and containing just twenty-five bushels of Indian corn in the ear, to be ranged in a continuous straight line, twenty-eight and one half feet apart. There will be about one hundred and eighty-five carts to the mile, and it would require more than two hundred and thirty-seven thousand miles of such a train to carry the maize crop of 1872, which was very near the quantity above referred to. The distance from the earth to the moon is reckoned to be two hundred and thirty-seven thousand miles. Again, the largest pyramid in Egypt, Cheops, was stated, by Diodorus, as six hundred feet in height and six hundred feet square at the base. This would give two hundred and sixteen millions of solid feet as the contents of the cube containing the pyramid—the latter being one-third of the former, or seventy-two millions of cubic feet. Now, a legal bushel is about two thousand, one hundred and fifty cubic inches, or nearly 1¼ cubic feet. Doubling this for a bushel in the ear, and dividing the cubic

feet of the pyramid by 2.4884 will give a pyramid of maize as large as the Cheops, containing between twenty-eight and twenty-nine million bushels. It would take thirty-eight such pyramids to represent the heap of Indian corn piled up by the farmers of this Union as the crop of 1872. Again, our national debt, in July, 1873, was stated as two thousand two hundred and thirty four million, four hundred and eighty two thousand, nine hundred and ninety-three dollars. The estimated value of the same crop for 1874 was five hundred and fifty million, forty-three thousand and eighty dollars. If four successive years produced crops of the same value, the amount would nearly pay off that debt.

The crop of Illinois, in 1862, was nearly one-fourth of the whole amount estimated that year; more than eighteen per cent. of the total of 1863; nearly one-fourth that of 1864 and 1865, respectively; and when, in 1867, all the States were included in the estimate, it was about one-seventh of the whole. Since then it has formed, in successive years, more than one-eighth; two-elevenths; one-fifth; nearly one-fifth; two-thirteenths; and nearly one-sixth in 1874. The second State for production since 1866 has been Indiana, in 1867-8; Missouri, in 1869; Indiana, in 1870; Iowa, in 1871; Missouri, in 1872; Iowa, in 1873, and in 1874.

It was to be expected that, as early as 1860, Illinois, with equal facilities for lake and river navigation, and nearly as much invested in farm implements, nearly three-fourths as many miles of working railroads, and about the same proportion of population, and of inhabitants of cities and large towns, with thirty-eight per cent. more territory, and a much larger area of rich, tillable land, more easily brought into cultivation, and more swine to feed, and a better chance for export, should so far surpass Ohio in the maize product;

which it did in that year by sixty three per cent. It also has a much larger range of latitude specially suited to this culture. In 1870 its population was only eighty-four thousand behind, and it probably surpassed the senior State in that of large cities and towns; had nearly fifty per cent. more railroad facilities, and more than sixty per cent. more swine of nearly equal average value, and had opened up a large area of new land; it then more than doubled its per centage of corn product over Ohio. But in 1874 its estimated crop was very much diminished, being only fifty-one per cent. more than that of the "Buckeye State." Missouri, having more square miles than Illinois, and similar natural advantages, may come to rival this mammoth maize State.

As to the acreage of maize, Illinois stood at the front from 1862 to 1874, inclusive; Indiana next, in 1862, '4, '5, '6, '7, '9; Alabama, in 1868; Missouri, in 1870-2, and Iowa, in 1871-3 and 4. With respect to the estimated value of the crops, it was highest for the whole Union in 1869. Illinois was first throughout, from 1862 to 1874, inclusive; Ohio next, in 1862-3 and 1871-3 and 4; Indiana second from 1864 to 1870, inclusive; Missouri in 1872.

As to the prices, the extremes of the Union show to the greatest advantage—California, in 1862, being highest, and Maine next. In '63-4 New Hampshire stood highest; in '65, Rhode Island and Connecticut being equal; in '66, South Carolina; in '67-8, Rhode Island; in '69 and '70, Florida; in '71-2 and 3, Nevada; in '74, Nevada highest, and Rhode Island next. As to yield per acre, Minnesota was highest in '62; Rhode Island in '63; Vermont in '64; Nebraska in '65; New Jersey in '66; Kansas in '67-9; California in '68; Vermont and Indiana in '70; Iowa in '71; Illinois and Iowa in '72 being equal; California in '73, with Kansas next; New Hampshire in '74, with California next.

Allusion has been made to the grasshoppers and their ravages, in the last years included in the above tables. The crop of Missouri was reduced one-third in 1873, and more than that in 1874; although the acreage was not diminished in both years. The yield per acre was reduced from thirty-seven in '72 to 16 in '74, while the price advanced, in the same interval, from thirty-two to seventy-four cents. In Kansas the crop fell off two-thirds, and in Nebraska one-half in '74, while the acreage was increased; the yield per acre in '74 being about one-fourth in Kansas and two-sevenths in Nebraska of that in '73. On the other hand, the prices in these States rose from thirty-one and twenty-eight to ninety-one and seventy-three cents in 1874.

Various other statistical tables are given in the U. S. A. Reports, connected, in some way, with maize culture, some of which may be easily calculated by a good arithmetician from the foregoing tables. For instance, the number of swine in one hundred inhabitants, in the census years 1860 and 1870; the bushels of corn to each one hundred inhabitants in the same years, and in 1850. The average size of farms, in acres, has been approximately ascertained in the several States for the same years, and show that at the South, where they have been largest (except in the Pacific States), the yield per acre has been much smaller. Of smaller averages of farms in 1870 were in Connecticut (ninety-three acres), Rhode Island (ninety-four), and Maine and New Jersey (ninety eight acres).

The yield per acre in these States, respectively, for the three years ending 1874 (averaged), was 30,4. $27\frac{2}{3}$, $27\frac{1}{3}$ and 37. In Georgia, where the average farm for 1870 was larger than in any other Southern State, the average yield of maize for those three years was not quite 12. The large farms of California show a different result; but there is very little maize cultivated there. In 1870 there was a very marked

decrease in the average size of farms from that of 1860 in all the Southern States. In Arkansas, Louisiana, Alabama and Florida there had been a marked increase of their size in 1860 over 1850, and also in Missouri. That of California decreased very much from '50 to '60, but increased slightly in '70. With these exceptions, there has been a decrease in their size at each decade since 1850, in all the Middle, Southern and Western States. One or two of the new Territories show an increase.

The census returns of values of farm implements and machinery for 1870 are highest in the following States, in the order in which they stand: New York, Pennsylvania, Illinois, Ohio, Iowa, Indiana, Missouri, Wisconsin and Michigan—in other States being under $10,000,000.

The average yield per acre of maize for these nine States, for the three years ending 1874, was about 31½ bushels.

XVIII.

ESTIMATED NUMBER OF SWINE IN THE UNITED STATES, FOR '64, AND WITH THEIR PRICE AND VALUE, FROM U. S. A R. in '65–6.

STATES, &C.	Jan. '64	January, 1865.				February, 1866.		
	No.	No.	Price. Und 1 yr.	Price. Ov'r 1 yr.	Value. Dollars.	No.	Av. pr'c.	Value. Dollars.
Maine	46,610	38,221	14.21	23.40	630,931	35,355	24.64	771,406
New Hamp.	42.584	32,790	15.50	30.00	627,101	31,333	21 00	660,198
Vermont	38,421	32,445	15.00	28.33	594,795	32,908	20.43	672.405
Massachusetts	63,263	50 611	14.85	31.43	961.360	45,549	22.61	1,029,858
Rhode Island	14,512	12,094	14.00	26.66	207,600	11,690	21.41	250,335
Connecticut	67,122	52 356	14.00	27 50	909,685	52.356	20.12	1,053,664
New York	823.508	699 983	11.90	20.82	9,890.762	671 981	14.33	9,632,890
New Jersey	219 759	183.459	12.58	23.00	2.785.828	192.630	15.64	3,014,653
Pennsylvania	976,150	829,728	9.21	20.81	10,048.006	892.032	11.94	10,658,259
Delaware	40,248	32,199	10.50	27.50	474,854	32,098	9.37	300 915
Maryland	381,788	328.927	7.50	17.66	3.302,429	368,396	9.17	3.380.033
Kentucky	1,922,740	1,602,284	5.34	11.52	11,031,725	1.794.556	7.37	13,234.850
Ohio	2,320,664	1,779,176	6.94	16.24	16,484,065	1.838,481	9 62	17,695,377
Michigan	299,642	339,696	5.25	13 23	2 463,645	351 017	8.66	3,139,845
Indiana	2,665,096	2,025.474	5.44	12.03	14.355,544	2 261,780	6.83	15.455.393
Illinois	2,421.703	2,034,231	6.85	14.18	17,662,212	1.976.208	8.73	17.257,236
Wisconsin	400.749	340,638	6.00	13.65	2.695.294	357.668	9 25	3.308,429
Minnesota	114,7 3	109,016	6.23	15.00	918,187	127,701	9.71	1,265 031
Iowa	1,581,741	1,423 567	5.68	12.00	10,335,098	1,423,568	7.71	10 982 827
Missouri	1,412,653	988,857	3.40	8.61	4,650,098	988.857	5 88	5,816 950
Kansas.	160,386	102,246	3.63	10 16	538.036	95,429	8.42	803 749
Nebraska	34.620	32,889	5.18	12.20	228.063	35.280	8.20	288,855
Total &c.	16.148.712	13 070,887	5.08	......	111.796.318	13.616.876	8.86	120 673,158

XIX.

ESTIMATED NUMBER OF SWINE IN THE STATES, WITH AVERAGE PRICE AND VALUE, FROM U. S. AG'L REPORTS.

STATES.	February, 1867.			February, 1868.				February, 1869.		
	No.	Av. pr'c.	Value.	No.	Over 1 y'r	Und 1 y'r	Value.	No.	Av. pr'c.	Value
Maine	37,472	15.39	$576 975	33,724	8.74	18.95	$380,827	32.037	13.99	$448,197
New Hampshire	33,208	20.30	674,372	28,890	9.66	20 00	353.752	27 445	18.54	508.830
Vermont	36.196	14.66	530,815	31,128	9.43	17.91	359.527	28,326	14.31	405,345
Massachusetts	44,538	15.43	687,436	43,201	9.58	22.70	555,561	38.016	15.32	582 405
Rhode Island	12 858	15.74	202.506	11,572	11.00	20.00	153.329	9.951	14.74	146,677
Connecticut	53.401	15.79	843.732	50,196	10.00	20 00	627 450	47,686	16.75	798,740
New York	692,140	12.00	8,306,410	685,218	6.91	14.75	6,077,879	616.696	12.02	7.412.685
New Jersey	202,260	13.57	2,744,668	202,260	8.31	16.73	2,106,537	190.124	14.93	2,838,551
Pennsylvania	1,025,836	8.45	8,678,573	1 056,611	6.29	12.76	8,355,146	919.251	10.59	9 734.868
Delaware	38.516	7.75	298,499	42.367	7.00	12.00	349,524	42,367	8.25	349.527
Maryland	383,876	7.00	2,690.561	364,682	4.88	10.22	2,266,495	331,860	8.44	2,800,898
Virginia	1.055,915	5.27	5,570,424	971,469	3.66	7.68	4.531,901	922,895	4.39	4,051,509
North Carolina	1,160,816	4.40	5,110,492	975,085	2.50	6.05	3,368,917	858,074	4.33	3,715,460
South Carolina	299,392	3.96	1,185,940	200.592	3.22	7.52	861.541	200.592	4.06	814,403
Georgia	1,596,536	4.33	6,921.479	1,404.951	3.45	7.75	6.357.399	1,362,802	3.75	5 110,507
Florida	94,568	2.90	281.340	90,785	3.16	7.41	383,338	103.494	3.16	327.041
Alabama	819,226	4.28	3.512.420	655,380	2.43	7.86	2.482,251	707,810	3.87	2.739.224
Mississippi	717,884	4.05	2.912 815	538,413	2.88	6.93	2,095.770	603,022	4.94	2.978 928
Louisiana	218,276	5.37	1.173.779	163,707	2.25	3.75	429.729	170,255	3.65	621.430
Texas	1 312,556	2.61	3,429 052	1,102,547	1.61	3.65	2,337.397	1,014.343	2.15	2,180.837
Arkansas	480,864	4.94	2,379,479	591.462	2.52	7.18	2.179,534	768,900	4.20	3 229.380
Tennessee	1,317,310	4.10	5,407,566	1,475,387	2.83	6.71	5,606 467	1,475,387	5.17	7,627 750
West Virginia	....	.....	....	300,000	2.00	4.87	815.250	270.000	4.40	1,188,000
Kentucky	1,884,284	4.66	8,790 185	1,733 541	2.80	6.31	6,375.095	1.560.186	5.93	9,251,902
Ohio	2 206.177	6.37	14.058,861	2,139 991	4.11	8.93	11,374.048	1,500,000	8.63	12,945,000
Michigan	414 200	6.44	2,667,448	418,342	4.27	9.22	2 304.015	401.608	7.06	2.835.352
Indiana	2 555 811	4.72	12,082.598	2 581.369	3.28	6.84	10 764.307	2.194,163	6.57	14.415 650
Illinois	2,272,640	6.08	13,829 014	2,181,734	3.22	7.33	9 266.912	2,007.195	8.42	16,900,581
Wisconsin	386 281	6.17	2.384 318	378.555	3 90	8.59	1,920,216	336 913	7.37	2.483.048
Minnesota	144 302	8.42	1,215.380	158,732	4.73	10 08	963.105	150.795	7.38	1.112 867
Iowa	1.665.575	5.05	8,423.647	1,748,853	3.29	8.21	7,904,813	1.748.853	8.11	14.183,197
Missouri	1,354,734	3.78	5,124.279	1,761,154	2.35	5.79	5,653 302	2.042 938	3.78	7,722.305
Kansas	127 875	8.05	1.030.355	140 662	4.70	10.21	854.869	137,848	6.82	940.123
Nebraska	47 981	8.04	386,006	54,698	4.50	12.10	350,063	65,637	6.39	419.420
California	....	.....	....	....	....	.....	....	429.007	5 52	2.368,118
Totals, &c.	24,093,534	5.43	13[illegible],111,124	24,317258	4.55		110,766,266	23,316,476	6.26	146,188,756

XX.

NUMBER OF SWINE IN THE UNITED STATES, WITH THEIR AVERAGE PRICES AND VALUE, FROM THE U. S. AG'L DEP'T.

STATES, &c.	February, 1870.			February, 1871.			February, 1872.		
	No.	Price	Value.	No.	Price	Value.	No.	Price	Value.
Maine	45.000	16.46	$740,700	67,600	9 87	$667,212	61,500	9.99	$614,385
New Hampshire	41,500	18.72	776,886	47,200	17.78	839,216	43,400	11.68	506.912
Vermont	43,600	16.62	724,632	66,700	17.00	1,133.900	61,300	9.52	583,576
Massachusetts	63,000	19.35	1,219,050	84,800	15.55	1,318,640	80,500	11.85	953,925
Rhode Island	13,500	15.66	211,410	20,400	14.62	298.248	18,500	10.49	194.065
Connecticut	67,600	17.65	1,193,140	69,300	18.75	1.299.375	65,100	11.63	757,113
New York	995,000	12.88	12,815,600	658,800	11.09	7,306,092	678,500	7.34	4,980 190
New Jersey	203.000	16.07	3,262,210	156.000	15.45	2.410,200	171,600	9.66	1,657,656
Pennsylvania	1,014,500	12.61	12,792,845	1,047 600	10.72	11,230,272	1,099,900	6.67	7,336 333
Delaware	44,900	9.12	409,488	46 000	6.25	287,500	46,000	5.00	230,000
Maryland	335,000	8.80	2,948.000	259.200	7.76	2.011.392	256,600	5.11	1,311,226
Virginia	904,400	5.42	4,901,848	757 500	5.60	4,242,000	810,500	3.58	2,901,590
North Carolina	850,000	4.78	4.063,000	841,500	4.15	3,492,225	875,100	3.00	2,625 300
South Carolina	308,000	4.26	1,312,080	317 200	4.69	1,487,668	339.400	3.30	1,120.020
Georgia	1,335,500	3.61	4.821.155	1,428.900	4.64	6,630 096	1,528,900	3.32	5,075.918
Florida	104,500	3.12	326.040	180.000	2.75	495.000	185,400	2.59	480,186
Alabama	716,500	5.40	3 869.100	900,000	4.30	3,870.000	981 000	3.66	3.590,460
Mississippi	643.000	5.02	3.227,860	850.000	4.40	3,740,000	918,000	3.45	3,167,100
Louisiana	170,200	3.04	517,408	300 000	4.30	1.290 000	288,000	4.51	1,298,880
Texas	1,004.000	2.67	2,680.680	1,200,000	2.76	3,312,000	1 272,000	2.69	3,421,680
Arkansas	830,400	5.32	4,417.728	863 600	3.28	2,832,608	1,036.300	3.82	3,958.666
Tennessee	1,505,000	4.81	7,239.050	1,520.000	4.49	6 824,800	1,580,800	3.32	5,248,256
West Virginia	357.000	5.26	1.877,820	319,000	4.80	1,531,200	331,700	3.65	1,210,705
Kentucky	1.955.000	5.91	11,554.050	1.994,100	4.81	9,591,621	2,113,700	3.34	7,059,758
Ohio	1,700.000	9 40	15,980,000	2,033,000	7.89	16.040.370	2.173,600	5.21	11,324,456
Michigan	462,000	8.19	3,783,780	517,400	7.37	3,813 238	532 900	4 67	2,488,643
Indiana	2,025.000	7.91	16,017,750	2,349 000	6.04	14,187.960	2,489,900	4.93	12,275 207
Illinois	2,005,000	8.15	16,340.750	3,363,000	7.52	25,289.760	3.598,400	4.70	16.912.480
Wisconsin	427 000	8.39	3,582.530	651 900	7.93	5,169.567	651,900	4 41	2,874 879
Minnesota	131,300	7.36	966,368	177.000	6.61	1,169.970	203,500	5.19	1,056,165
Iowa	2,500.000	8.07	20.175 000	3,100,000	7.15	22,165 000	3,596.000	4 76	17.116,960
Missouri	2,300,000	5.79	13 317.000	2.200,000	4.34	9.548,000	2,530,000	3 25	8,222.500
Kansas	516 000	7 05	3,637 800	304,800	8.88	2,706,624	381,000	5.51	2.099.310
Nebraska	125.000	8.05	1,006,250	76,200	8.58	653.796	102,800	5.72	588,016
California	750 000	4.47	3,352.500	459 000	5.94	2,726.460	440 600	5.05	2.225,030
Oregon	160.000	3.00	480,000	149.500	2.51	375.245	158.400	3.79	600,336
Nevada	100 000	6.50	650,000	4 300	7.49	32.207	4.300	7.00	30.100
Territories	....	.....	....	77 000	7.57	582.890	89 300	7.12	635,816
Totals and averages	26,751,400	6.99	187,191,502	29,457,500		182,602,352	31,796,300	4.36	138,733,828

XXI. (*a*)

ESTIMATES FOR JANUARY, 1876, FROM U. S. AG'L DEP'T.

SWINE.

STATES, ETC.	Number.	Av. Price	Value.
Maine	58,800	$11 66	$685.608
New Hampshire	37 300	16 20	604 260
Vermont	51 800	12 19	631 442
Massachusetts	75 600	18 03	1,363 068
Rhode Island	16,300	17 05	277.915
Connecticut	57,900	16 73	968 667
New York	568,700	11 39	6 477.493
New Jersey	153.000	13 83	2 115.990
Pennsylvania	875.000	11 50	10,062,500
Delaware	46 700	10 61	495.487
Maryland	233,500	7 10	1,657.850
Virginia	589,800	4 45	2.624 610
North Carolina	758.300	4 01	3.040.783
South Carolina	275 900	4 11	1,133.949
Georgia	1,360,700	3 91	5.320.337
Florida	175,400	2 26	396,404
Alabama	755.900	3 99	3,016,041
Mississippi	792,900	4 31	3 417,399
Louisiana	222,600	3 98	885,948
Texas	1,090,000	4 09	4,458.100
Arkansas	901 200	3 91	3.523 692
Tennessee	1,026,400	5 22	5.357.808
West Virginia	248,400	5 38	1.336 392
Kentucky	1,604,300	5 51	8,839,693
Ohio	1,596,100	8 06	12.864 566
Michigan	459,700	7 93	3,645 421
Indiana	2,136.000	7 70	16,447 200
Illinois	2,640,100	8 63	22,784 063
Wisconsin	540,700	7 58	4 098 506
Minnesota	213,400	6 99	1.491 666
Iowa	3 296,200	8 08	26.633.296
Missouri	1,874,300	5 94	11,133 342
Kansas	246 500	8 91	2 196 315
Nebraska	80,900	7.58	613,222
California	363 300	7 17	2 604 861
Oregon	181 500	4 41	800 415
Nevada	5,200	9 00	46.800
Territories	116 500	8 75	1 019 375
Total	25 726 800	----	175 070 484
Grand average of prices	---------	6 80	---------

XXI. (*b*)

(*j*) STATISTICS OF OHIO, FROM REPORTS OF STATE BOARD OF AGRICULTURE, &C.

INDIAN CORN.

Counties.	Acres planted. 1862.	Bushels produced 1862.	Acres planted. 1872.	Bushels produced 1872.	Av y'ld per acre '47–'56.	Av y'ld per acre 1872.
Adams	28,287	477,225	33,330	889 509	35	26.68
Allen	21,935	761,017	29,774	1,153,393	38	38.74
Ashland	19.075½	507,328	21,366	911,069	52	44.04
Ashtabula	11,648	292 271	12,280	579,835	39½	47.30
Athens	18,038	610,160	19,968	670.379	39	33.57
Auglaize	23,300	510,111	28,865	1,122.519	...	38.88
Belmont	25,969	786,481	26.947	1.188,142	45½	44 09
Brown	38,150	930,469	42,575	1,408.680	38⅓	33 08
Butler	58,353	2,215,510	57.690	2,738,309	47½	47.46
Carroll	10,880	251.868	12,572	517.912	36½	41.19
Champaign	35,779	1,369,222	41.863	1.599 281	36¼	38.20
Clark	30 530½	1,088,186	39.965	1,794.483	37¾	44.90
Clermont	38.617	994.773	38,308	1,460.138	44⅓	38.11
Clinton	47,490	1,729,244	57,677	2,449,689	41⅓	42.47
Columbiana	14,918	466,074	17 602	680,360	39½	38 65
Coshocton	29,634	663.172	30,905	1,259,625	48	40 75
Crawford	21,915	607,647	24.596	991,294	37½	40.42
Cuyahoga	9,568	306,103	9 918	463,994	35	46.78
Darke	36,067	1,245,168	49,437	2,166 965	39⅓	43.83
Defiance	10,703	320,722	15.278	653.284	45⅔	42.76
Delaware	24.822	791.153	33.063	1 375,538	44⅓	41.60
Erie	12.519¼	388.752	17 941	726 010	40⅓	40.46
Fairfield	39.515	1,195,407	50,272	2,160,383	36½	42.97
Fayette	52.277	2,065,739	66,762	3 093.695	46⅓	46.34
Franklin	53,846	1,749,253	65,952	2,680,820	50	40.64
Fulton	9,305	296,769	17,342	698 874	40	40.29
Gallia	18,768	422,650	22,569	676 920	36⅔	30 00
Geauga	5,800	182.598	5,691	292.308	47½	51.36
Greene	39,868	1,477,753	51,770	2.388 519	39	46.13
Guernsey	19,226	463,723	20.239	767 380	41⅓	37.91
Hamilton	29.961	1,066,294	23 404	877.947	38	37 51
Hancock	28.107	665.298	37.005	1,587 935	35½	42.91
Hardin	25,149	541,229	21,928	963.400	35	43.93
Harrison	14,320	449 419	14,406	627.322	41	43.54
Henry	7,501	194,838	15,404	696,090	41⅔	45.18
Highland	57,276	1,474,425	57.230	2,097.653	42½	36.65
Hocking	15,177	400,182	17.622	556,462	36	31.57
Holmes	16 856	398 095	19.624	715,819	40	36.47
Huron	23,836	669 646	26,283	1,033,180	47¾	39.31
Jackson	16,481	321,100	17,965	495.595	32	27.58
Jefferson	13.507	363,262	14.195	597,209	38	42.07
Knox	31,085	762,694	30 639	1,315 785	38	42.94
Lake	*56,660	181,208	5,375	244 046	45½	45.40
Lawrence	16 340	257,147	16,177	456.441	40½	28.21
Licking	44,637	1,303,048	48.911	2.266,797	45	46.34
Logan	27.743	963,557	32,677	1,348.496	32	41.27
Lorain	13,928	399 031	15.265	648 212	38¼	42.46
Lucas	6,073	223 051	9,663	608,926	30	63.01
Madison	35,129	1,133,327	54,296	2,446,336	40	45 05
Mahoning	11,308	247,970	11.932	590,741	41⅓	49 50
Marion	27,814	810,105	34 412	1,455,997	35⅓	42.31
Medina	14,197	456,909	13 505	550,336	37	40.75
Meigs	15,370	393,570	17,259	547 676	35	31.73

OHIO STATISTICS (CONTINUED).

Counties.	INDIAN CORN. 1862. Acres planted.	1862. Bushels produced	1872. Acres planted.	1872. Bushels produced	Av y'ld p'r acre '47–56.	Av y'ld p'r acre 1872.
Mercer	18,096	506,171	28.275	1,175.560	34	41.57
Miami	40,580	1,451.957	43,918	1.753,554	41½	39.93
Monroe	16,836	383.178	18.864	632,270	32½	33.51
Montgomery	34,752	1,282,322	44.528	1,630,941	46	36 62
Morgan	17,096	431,646	17,548	637,771	37	36.34
Morrow	20,117	525.931	21,261	882,377	30	41.50
Muskingum	31,286	854,339	34.369	1,410,034	47½	41.02
Noble	21,577	519,760	21,993	883.565	33	40.17
Ottawa	4,188	89,019	7,717	365,080	33⅓	47.30
Paulding	4.438	137,093	9,291	368,998	56	39.60
Perry	19.197	513,300	18,297	760.921	37½	41.58
Pickaway	64 977	1,991.861	83 289	3,375 648	44	40.53
Pike	25,594	849,860	26,590	849,171	35⅔	31.93
Portage	9,642	303,927	10,051	627.202	37	62.40
Preble	38,958	1 549,223	41,048	1,597,695	31	38.91
Putnam	17,057	461,768	26,051	1,077.445	51⅔	41.35
Richland	23 516	618,781	25,176	905,198	34	35.95
Ross	67.694	2 267,721	71,673	3,102 757	39	43.29
Sandusky	13,566	323,021	24,835	979,040	39	39.42
Scioto	33,077	441,740	23 859	820 528	52½	34.39
Seneca	22,923	633,878	30,067	1,168,732	43⅓	38.87
Shelby	26,786	604,403	28,793	995,341	30½	34.56
Stark	18,073	567,170	24,198	1,707,601	33	70.57
Summit	11,074½	369,131	13 623	851,802	37	62.52
Trumbull	9,888	318,609	11 719	674,391	36	57.54
Tuscarawas	19,908	493.185	21,746	849.318	38½	39.06
Union	28,818	862.567	38,917	1,649,271	41	42.37
Van Wert	11,770	306,295	21,196	903,491	33	42.62
Vinton	11,443	274,377	14,116	455.000	..	32.23
Warren	42,924	1,631,978	47,954	2.252 572	46	46.97
Washington	23,575	609,932	24,885	806,744	42½	32.41
Wayne	22.778¼	676,364	27,751	1,268,801	44½	45.72
Williams	11,467	369,699	18,455	784,270	28	42.49
Wood	14,991¼	394 504	36,343	1,457,862	35	40.11
Wyandott	21,610	557,591	44,163	1,071,875	35	24.27

(*k*) *Prices in Special Markets of U. S. Republic.*—The application of the great law of prices, that of demand and supply, to the maize product, must be guided by the political, as well as meteorological and industrial facts of the time. There was much exported in the early years of the Republic, in proportion to the population, and this, doubtless, stimulated prices.

Quotations of market prices, even in our greatest cities, were not as full and frequent as they are now. The following fragmentary quotations are taken from the Price Current,

of New York City, in old copies of the New York Spectator, for the years 1799 and 1800-1, 2 and 3, including those of hog products:

	Corn, per bushel	Hams per lb.	Pork, per bbl	Prime per bbl.	Mess. per bbl.
1799, July 17	68c	10-11c.	$12½	$13½	$16
" " 24	68 cts.	14 cts.	$12½-¾	13½-¾	"
" " 31	68-72 "	"	"	"	"
" August 7	68-75 "	"	"	"	"
" " 28	78-81 "	"	"	$13½-14	"
" Sept. 4	North, do	"	Carg 12½	13½	"
" " 11	"	"	"	"	"
1800, November	$1 to $1 6	14-16 "	" 13-13½	" 15½-16	$19-20
" December	"	13 "	" 13-14	Same.	"
1801, January	"	12-13	" 15-16	" 17½-18	" 21-22
" Feb. 11, 18	$1 to $1 9	12-13 "	"	" "	"
" " 25, 28	" 1 6	14 "	" 16½	" 18	" 22
" Mar 7 to 18	"	14 "	"	"	"
1802, Nov. 8	"	14-16 "	" 12½ 13	" 15½-16	" 19-20
" Nov. 24	69-70 cts.	16 "	" 13-13½	" 14	" 17½
" Dec. 1	"	15 "	" 12½-13	" 13½-14	" 15-16
" " 8	68-71 "	12 "	" 12	" 13	" 15
" " 15	"	9 "	" 12½	" 13½-14	" 15-15½
" " 25	"	"	" 13	" 14	" 15
1803, Feb. 9	"	12-13 "	" 13½	" 15	" 16-16½
" " 16	"	10-11 "	" 13½	" 15	"
" Mar. 2	"	Same.	" 13	" 14½	"

It will be observed that the rise in prices was very rapid in the last months of 1799, the year in which General Washington died; the troubles with the French Government having been settled in September, and in the following year the seat of the American Government being transferred to Washington City. The exports of Indian corn were 41 per cent., and of corn-meal 45 per cent. in 1800, over those of 1799, and the increase of prices of these articles was in nearly the same proportion. Peace at last came to Europe, in 1802, and the rapid settlement and admission as a State of Ohio greatly increased the area for corn planting, and, doubtless, the product. Our territory was greatly enlarged, in 1803, by the purchase of Louisiana. The prices fell to their former rates in the same year, although the exports

were as yet undiminished. A few items from an old account book, kept at Marietta, the oldest town in Ohio, from 1802 to 1818. will give some idea of the retail prices of corn and pork in that State during that interval. In 1802 fresh pork was sold at 4 cents per lb.; in 1803 pork by the quantity at 5 cents, and some at 3¾ cents per lb., and corn bought at 46½ cents per bushel; in 1804 a customer was credited with eight bushels at 50 cents each; bacon sold at 12½ cents per lb. In 1805 fresh pork brought 5 cents; this was in September; in the winter previous clear pork sold for 17 cents; in 1807 corn sold in May at 60, in July at 75 cents. In January, 1808, pork was sold at 10 cents per lb, and in November, corn at 67½ cents per bushel; in 1809 corn at 33⅓ cents; also in 1810, when wheat brought 75 cents, and pork by the quantity 3 and 4 cents; in 1811 pork was charged at 8 cents, and in October of same year corn at 33 cents; in 1812, corn at 25 cents; in 1813, pork at 10 cents; fresh at 6 cents; in 1815, pork at 12½ and 16 cents; in 1816, lard at 12½ cents; in 1817, pork at 12½ cents; in 1818, October, corn sold at 24, and in November at 40 cents.

Business was said to be more lively in the earlier than the later years of the above interval; ship-building being carried on there awhile to some extent. Corn seemed to have attained its highest price about the time Congress laid the embargo in 1807, in consequence of the "decrees" of France and "orders in council" of Great Britain, which bore so hard on American commerce. The United States exports fell to a very low figure in the year following. After that, it is seen that in this Ohio town the price of corn fell more and more, till it reached 24 cents in 1818. The great extension of acreage from the rapid settlement of Kentucky, Ohio and Indiana, had greatly enlarged the supply before proper facilities for transport had extended the demand. At

the same time, the prices of pork were maintained; fresh pork having been lower in 1802 than in 1813, and bacon, in 1804, selling for the same that pork did in 1817. This shows that cured meats were at a premium, and that packing, which is now so scientifically and economically done, was then in its infancy in the West. The following quotations of prices for Indian corn and *provisions*, so called, at Philadelphia, New York and Baltimore, for the years 1806 and 1807, and 1809 to 1812, are taken from old volumes of the Philadelphia Aurora, New York Spectator and Baltimore Whig, issued tri-weekly or otherwise, for the country in those years; and first, at Philadelphia:

In 1806, from August 19 to December 24, mixed corn sold from 52 to 60 cents per bushel. It was the same on January 14, 1807. On the 22d of April it was 60 to 68 cents. Indian meal, from August 19 to Nov. 18, 1806, sold at $15 per hhd., or $3.25 per bbl. On August 26 the bbl. price was $3.25 to $3.50, and so continued till the 25th of November, when the hhd. fell off $1; the last quotation, on April 22d, being $14 per hhd. An imperfect cask would endanger more meal for being a large one. Late quotations have less to say about the hhd. Bacon began with 11 cents in this interval, but on the 24th of December lost 1 cent, and so continued till the 22d of April, 1807, probably coming into sharp competition with fresh meat, or newly cured during the cold weather. Hams, on August 26, brought 14 to 15 cents per lb., and on the 11th of November gained one more cent, which was lost on January 14, 1807, and in April was quoted at 12 to 15 cents. Lard began in August with 19 to 20 cents per lb; probably it was the new rendering that reduced it to 16-17 on November 11, to 15.17 on December 24, to 15 on January 14, and to 14 on April 22d following.

Philadelphia pork was of two kinds, *common*, in August \$23-24 per bbl, and *mess* \$26-27. November 11 reduced the first to \$19 20 and the second to 23-24, which, in January, became \$22, and in April \$20.

Probably one or more of these cities supplied San Domingo, in part, with grain; but this Island, in 1809, was under siege, a condition carrying the law of prices to great extremes, and in this case bringing corn up to 50 cents per lb.; fresh pork and ham to \$2, and lard to \$3 per lb., and salt pork to \$700 per bbl.

The monthly New York prices are thus averaged from the quotations of the Spectator from April 12 to December 12, 1809; after that, those of Baltimore, from the Whig, are compared with them, as far as they go, up to May 5, 1812. As the quotations do not appear in every number, and the Spectator was a tri weekly and the Whig a weekly, the number of quotations averaged is stated in parenthesis, just after the name of the month, for New York, and in the first Baltimore column:

	Ind corn North. Bushels.	Corn m'l per hhd. 800 lbs.	Lard per lb. Cts.	Hams p'r lb. Cts.	Pork Cargo. Dollars.	Pork Prime. Dols. Cts.	Pork Mess per bbl. Dols
1809 Ap (3)	62.3c.	\$18	10⅔–12	10–13	10 50	12 50	16
" My (8)	71¾	18½	11–12	11–14	11 62	13 50	16-17
" Jun (7)	73.3	18	11–12	11–14	12	13 28	"
" J'ly (7)	77	18	11	10–14	11½–12	12.50-13	16½-17
" Au (9)	81.5	18	11	14–15	11½–12	"	"
" Sep (7)	82.8	18	11–12	"	10½–11	11.50-12	16-16½
" Oct (5)	N 87 S. 80 6	19½–22 bl 4-4½	"	"	10	11 50	"
" N'v (7)	N 1.00 S. 94	25 hd. 5 bbl	"	"	10	"	"

The hyphen placed between two numbers in these tables stands for the preposition *to*, and indicates the relation between the extremes of price of the given article at the given time; for instance, in April, 1809, lard was 10⅔ to 12c. per lb.

XXII.

Years, months and No. of quotations in same.	Range of Monthly Prices at New York. Indian corn Cts. per bu. N'th	So'th	Corn-meal Dollars. P'r hg	P'r b'l	Cts. per lb. Lard.	Hams	Pork, dollars per bbl. Cargo	Prime.	Mess.	At Baltimore. No. of quotations.	Ind corn. per bu	Corn-meal. p'r bl	Bacon cts per lb.	Mess pork per b'l
1809—Dec. (5) .	97-100	90-94	25	5	12-13	14 15	10 12	11½ 12½	16 17	2	75-82c	4	10 11	$17
1810—January (7)	97	85-90	23-25	5	14	10-12	12	13½-14	17-18	3	73-80	4	10 11	17
" February (4	78-100	68-95	23-4	5	14	12	12½-13	14-14½	18 20	....	......	......	......	......
" March (9)	78 80	68-75	23-4	5	14	12	12¾ 13	14 14½	19-20	......	......	......	......	......
" April (7) .	78-80	70 75	23-4	5	14	12-14	12¾-13	14 15	20-22	......	.	......	. .	......
" May (9) .	78 80	72 75	23-4	5	11-13	12	12¾ 13	14½-15	21 22	2	70 75	......	9-10	16-17
" June (8) .	80	75	23	5	11	12	12½-13	14 14½	21 22	1	67 70	4 50	9	16-17
" July (5) .	87 90	80 84	21½-23	5	11-12	12	12½	14 14½	21 22	......	......	......	......	......
" August (7)	94 100	85 90	22½-23	5	11-12	12	12½-13	14 14½	21 22	1	75 80	4 50	8-10	16 17
" Sept. (7) .	94	85-90	22½-23	5	11 12	12	12½ 13	14-14½	21-22½	2	73 80	4.50	8-12	16 17
" October (8)	94	85	22½-23	5	11 12	12	12¼-12¾	13½-14	22	......	......	......	.	......
" Nov. (7) .	94	80-89	22½-23	5	11 12	12	12 12¾	12 14	22	2	65-70	4 50	12 15	17
" Dec. (8) .	94	80 85	22½-23	5 5¼	11-12	12	10½ 12	13 14	20-22	......	......	......	......	......
1811—January (7)	94-100	80-85	23 24	5-5½	11-14	12-14	11½ 12	13½-14	19 20	4	62 85	4 50	15	17
" February (4)	100	....	24	5.50	13 14	14	12	13 14	20	4	55-85	4 50	15	17
" March (8)	75-100	....	24	5-5½	12-14	11 14	12	13 13½	20	1	60	4.50	10 11	17
" April (5) .	75-81	70-75	24	5-5½	10 12	9 12	11¾ 12	13 13½	18 20	4	64 73	4.50	10 11	17
" May (1) .	75 81	70	24	5 5½	12½ 13	10-12	11¾	13¼-13½	18	1	70 75	4 50	10 11	16
" June (3) .	75-84	70 73	24	5-5½	12½-13	10-12	11½-11¾	13-13½	17 18	4	60 83	4.50	10 11	17
" July (3) .	75 100	66 78	22-24	4¾-5¾	12½	10-11	11½	13-13½	17-18	......	......	......	......	......
" August (3)	93-100	78	22 23	4.75	12½	10-11	11½-12	13 14	17-18	1	70-75	5	11	17
" Sept. (3)	81 93	70 78	22 22½	4.75	14	10-11	13 14	15-17	18 19	1	75	4.50	11	16
" October (2)	100	90	22 25	4 75	14	10 11	14	17-17½	19 20	4	75-80	4.50	12-13	17
" Nov. (2) .	94-100	85 100	22½-24	5-5¼	11-14	10-12	12-14	13½ 17½	19-22	......	......	......	......	......
" Dec (1) .	94	87	24	5	13	10 11	12	13½	14	2	75 78	4.50	12-13	16 17
1812—January (6)	75 87	87-100	22 24	5	12 13	10 14	12-12½	13 13½	15-16	2	60-80	4 50	11 12	16
" February (1	87	100-6	24	5	13	12 14	12-12½	13-13½	16	2	70-75	4.50	11 12	16
" April (2) .	60 66	62 68	.....	4.25	11 12	9 12	13	13½-14	16½	.. ..	......	......	......	......
" May (1) .	60-62	62 68		4 25	11-12	9 12	13	13½-14	16½	....	......	.....	.....	....

For December, 1809, and January, 1810, hog's lard for Baltimore was quoted at 14 cents per lb; prime pork at $15 per bbl; cargo at $10 to $11; Baltimore navy at $16; Southern second at $14, and Southern third at $12.

The porker has long been recognized in agricultural practice as the best carrier of the maize product to market. His feet, compared with those of other farm animals of the same average weight, are small; but when half-grown, especially when escaping from confinement, he makes use of them to great advantage. And when ripe for his final conversion into pork, bacon and lard, the ten bushels of corn with which he is loaded do not prevent him from taking long walks in company with his kind. But since the railroad has presented such facilities for the transport of live-stock, this fat producer often enjoys a long ride before giving up his life to increase his master's comforts. But before the railroad, or any other fast conveyance, had cheapened inland live freights, the prices of Indian corn made a showing of such a proportion to those of pork, lard and bacon, as to prove that this grain was the main reliance of those who produced these articles. This will be seen if the above tables are carefully examined.

Among the earliest records of the American prices for maize after the establishment of our present government are those contained in the letters of General Washington to his brother agriculturalists at home and abroad, and in his published diaries and plans for farm management. Mr. Sparks, the editor of these, and other relics of the great patriot's literary labors, has introduced one of his schemes for rotation which extended over some years subsequent to his death. He estimated, for instance, the probable yield for 1800 of some seventy-five acres of his farm, according to a contemplated rotation, at 12½ bushels per acre, which would bring 2s. 6d. per bushel, being 6d. less than the price was stated to be in 1789. It does not appear whether this was according to the old South Carolina currency of 4s. 6d. to the dollar, or according to that of New Jersey, which required 7s. 6d. for a dollar.

In July, 1799, the price of corn at New York to that of mess pork was nearly as one to twenty-three and one-half; in November, 1800, it was about as one to twenty; in December, 1802, as one to twenty-one and one half; on December 2, 1809, as one to seventeen and one-third. The exports of Indian corn had greatly diminished after 1804, and also of hogs and pork, in consequence of the oppressive measures of the European belligerent powers; one hundred and sixteen American vessels having been captured by the British in 1805, under their Orders in Council, and one hundred and ninety-four in 1807; and there being a greater supply for home consumption, the price would necessarily fall, as it appears by the Philadelphia prices, above quoted, to have done. Pork, occupying a much smaller space in the vessel, in proportion to its value, would have a better chance of being profitably exported, especially to places which the cruisers would be less likely to visit. It was probably the excess of the pork over the maize exports that made the latter, at Philadelphia, in 1806, stand to the former as one to forty-seven. The ratio of the Baltimore prices of these articles was about the same as at New York in 1802. The high prices of maize in November, 1800, were repeated in New York in November, 1809, and in the latter part of 1816 rose to $1.80 per bushel. Corn was so scarce for feeding purposes that flax-seed, which had been largely exported to Ireland, was recommended as a substitute. Mr. Ewell, in the same year, wrote for the National Intelligencer, (published at Washington City, and mainly devoted to reports of Congressional debates, and probably having a very wide circulation through the Union), in favor of grinding and cooking Indian corn, in view of its great scarcity, for feeding domestic animals, as though that was then a new thing to American farmers.

The country papers in the West, during the early years of this century, were more in the habit of quoting prices at New York, Philadelphia or Baltimore than in the young towns they represented. The Western Spy stated that lard in New Orleans, on the 26th of July, 1817, of prime quality, sold for 22 cts. per lb., which was copied into the American Friend of August 29, 1817. Occasionally, however, they ventured on a price current of their own. For instance, the American Friend, issued at Marietta, Ohio, contained the following prices at that place, at the following dates:

1820.	Corn per bu.	Corn-meal per bu.	Bacon per lb.
June 30	40 cents	37 to 40 cents	7 to 8 cents
July 28	40 "	37 to 44 "	7 to 8 "
August 11	40 "	37 to 44 "	7 to 8 "

If a barrel of mess pork contained 200 lbs. and sold for $16, each pound would be 8 cts., and the ratio of corn at 40 cents to mess pork at the above price would be as 1 to 40, showing that bacon was more valuable, in proportion to maize, at Marietta in 1820 than at New York in 1809. The The Ohio Monitor (Columbus, O.,) for November 3, 1821, gives the Philadelphia price current, with the items of Pennsylvania corn at 50 cts. and Southern at 47 cts. per bushel, and bacon at 6 cts. per lb. If bacon bore the same price as mess pork at that city, the ratio of a barrel of 200 pounds to a bushel of the Pennsylvania corn would be about 24 to 1. The difference in the prices at Marietta and Philadelphia, at nearly the same times would not begin to pay for the transport to the latter place in 1820. Most probably the Southern maize came by sea, and that very little Western reached the Eastern cities in those days. The same Columbus journal, however, on the 25th of January, 1822, only two months after its former date, quotes the Philadelphia prices of maize at 80 cts. for Pennsylvania, and 75 cts. for Southern. The fluctuations in these quotations were proba-

bly much greater and more rapid than they are now, when freights are comparatively fast and cheap. The Scioto Gazette of November 19, 1823, quotes corn at Chillicothe, O., at 20 to 25 cts, and cornmeal at 25 to 37½ cts. per bushel, and bacon 6 to 10 cts per lb. The quotations for Dec. 23 were the same.

Some idea of the standard price of Indian corn and swine products at the exporting cities, in the early part of this century, may be obtained by dividing the values of the same articles exported, as set forth in U. S. documents, by the respective quantities—bushels or pounds. This would give for the export price of Indian corn, for the year ending September 30, 1827, 54 cts. per bushel, and \$3 27 per bbl. for cornmeal. We have chosen as the representative quantities those exported in that year to the Swedish West Indies. In the Government statement of exports the quantities of pork, hams, bacon and lard are lumped together in barrels and pounds and then valued. Allowing 200 pounds for each barrel, the above process would give about 5⅓ cts. as the average of these products for a pound, which would be lower than the last named quotation for bacon at Philadelphia. For the year ending September 30, 1836, the export price of corn was 97 cts., and that of cornmeal \$4.21 (to the Swedish West Indies), and the average of pork, lard, hams and bacon about 9¾ cts. Supposing the barrel of mess pork was reckoned at \$18, the ratio of the prices of maize and mess pork, by the bushel and barrel respectively, would be as 1 to 18. The Erie Canal had already been opened then, increasing the value of Indian corn.

Returning to the old newspapers, which are probably our best guide: The American Watchman, issued from Wilmington, Delaware, gives a summary of the prices at different points and dates in 1815, viz.: July 14, at Norfolk, Va, where the authorities did "not recollect ever to have seen

the market so badly supplied, nor such exorbitant prices demanded for every article of food," bacon sold for 20 cts., and meal at the *moderate* price of $1.— per bushel. [The blank for cents is left to be filled by the reader's imagination, as a sharp tooth has eaten off the number from the original document.] The New York price for cornmeal was quoted at $5 to 5 50 per bbl., and $23 to $24 per hhd. of 800 lbs; white and yellow corn at $1 to $1 03; hams at 16 to 17 cts. On August 5 it gives quotations as of July 28: At Richmond, Va.—Corn $4.50 to $5 per bbl; cornmeal, $1.17½ to $1.25 per bushel; bacon, 16 to 18 cts. At Baltimore as of July 31—Corn, $1.05 to $1.10 per bushel; at Charleston, $1 to $1.12½; bacon 14 to 15 cts. The same journal for August 19th complains of drought as prevalent in the section it represents, and notices destructive hail-storms in Canada.

Some imperfect files of the Cincinnati Gazette, printed for the country, were found to contain no prices current from August 5th, 1815, to June 1, 1822—probably some of the missing numbers did. At the last date there were quotations for New Orleans of May 4 – Corn per bbl., in the ear, 75 cts; cornmeal, $2 to $2 50 per bbl; bacon hams, 9 to 10 cts. per lb.; lard, 7 cts. per lb., and mess pork, $11 to $11.50 per bbl. The number for November 23, 1824, contains a detailed price current, with the title torn off, which gives the prices of pork from $7 to $8 per bbl.; lard, 6 to 7 cts. per lb, and hams baconed, at 5 to 6½ cts. A full review of the Cincinnati market for July 16, 1828, appears in the issue of the previous day (the weekly, Liberty Hall and Cincinnati Gazette), but does not include grain. Mess pork was $10 per bbl., and prime $8; lard, in bbls, 4 cts., in kegs, 4½ to 5 cts; bacon, hog round, 4 to 4½ cts.; hams, 6 to 8 cts. The probable reason why so little notice is taken of Indian corn in these early Western city prices is because the facilities for

carrying it to great markets were so few. This grain could be shipped down the Ohio and Mississippi, but it was a long distance to New Orleans, and the omission of it in this review shows that there was no great demand for it at Cincinnati.

About this time, the author of this work, then a small boy, was employed for some nine months in a store at Coshocton, Ohio, which, like other country stores, dealt in dry goods, groceries, hardware, &c., and received, to some extent, produce and farm manufactures in exchange. At that time, Zanesville, some thirty miles below, on the Muskingum River, containing some large water-mills, was the grain emporium for that section. It was generally wagoned there, the river improvement not having then been made. One afternoon a team laden with wheat destined for Zanesville, stopped at the store and stated that they had come a considerable distance from an adjoining county, and were tired of the journey, and if fair terms could be made, they would take the price of their load in goods. Twenty-five cents a bushel was offered them for their wheat, and accepted and exchanged for goods at a heavy profit. At that time the price of wheat at Zanesville was 28 cts. The price of Indian corn is not recollected, as the merchants preferred wheat, tow-linen and home-made linsey. Some ten years later, when residing in Southern Illinois, where the soil was as fertile as the climate was sickly, the author was told of fields of corn sold standing at 6 cts. per bushel. The great Illinois railroads were then all on paper. Flat-boats were then the great resource for shippers of maize, and New Orleans and the intervening river ports furnished the leading markets.

On the 9th of October, 1828, the Liberty Hall, &c., contained a more complete review of the market. Corn was 25 cts. per bushel; bacon hams, 6 to 8 cts.; country do,

6¼; lard, 5 to 5½; hog round, 4½ to 5; middlings, 5 to 5½, and shoulders, 3 to 4. This review was now corrected weekly for the daily Gazette by Thomas Clark. Live hogs sold for 2½ to 3 cts. per lb. Barrel pork, in due time, appeared on the list; clear at $10 to $11; mess at $8 to $8 50.

These prices continued, with very little change, the remainder of the year. Mast-fed hogs brought about 30 cts. less per 100 lbs. than corn-fed.

A review of the New York market, from the Journal of Commerce of October 13, appears in the daily Gazette of October 24, quoting Northern yellow at 55 to 56 cts.; Long Island white, 50 to 52, and Southern 40 to 42 cts. Southern corn, which, so far, has generally brought less than Northern in New York and Philadelphia, has gained on its rival in more modern quotations. This may be caused by the great increase in the demand for this grain in the cities as horse feed, and, perhaps, by its growing use for making cakes or bread, the large, soft white variety being more produced at the South.

The average New York prices of maize for October 13, 1828, were about double those of Cincinnati. The maize and mess pork ratio for Cincinnati in December, 1828, was about 1 to 12 in price. The review of the Boston market for the week ending August 3, 1821, shows very nearly the same prices for maize as at New York, Northern being held at 51 to 52, and Southern at 43 to 45 cts. Wheeling, Va., was a growing place in 1825; its Gazette of July 23, in that year, quoted corn at Baltimore, on the 11th, 45 to 46 cts. for white, and 44 to 45 cts. for yellow. Its issue for September 29 quotes corn-meal at Baltimore, on the 12th, at $2 75 per bbl. and $12 per hhd. The same journal, for May 31, 1828, quotes New Orleans prices for May 3—Bacon hams at 7½ to 8 cts, and sides at 5 to 6 cts.; and on June 7, quotes the New Orleans prices the same for these articles, with the

addition of lard at 6 to 7 cts; mess pork at $11.50 to $12; prime at $10, and cargo at $8. The subscriber to the Wheeling Gazette, residing in that city would then read the Baltimore quotations when they were from twelve to seventeen days old, and of New Orleans prices when they were four weeks old. Compare this with the journalism of half a century later, and it will be seen what the telegraph has done for commerce.

The Wheeling Gazette for the 12th and 26th of November, 1828, and 7th and 14th of January, 1829, quotes cornmeal in its own market at 37 1 5 cts. per bushel, and pork at 3 and 4 cts per lb, and on the 8th of July, the former at 37 to 50 cts., and the latter at 4 and 5 cts. On the 31st of January, 1829, corn is quoted at 25 cts; mess pork, $9 to $10; making the bushel and barrel price of corn and pork as 1 to 40; prime at $7.50 to $8, and fresh pork in hhds 2⅓ to 3 cts. per lb; lard at 5 to 6 cts. Nearly the same quotations appear in the weekly issues for February and March, 1829. Bacon was once or twice quoted at 6¼ cts. In the previous year, operations were begun on the work of the Baltimore and Ohio Railroad, it being stated, in August, 1828, that the work had been put under contract as far as Endicott's Mills. There was considerable speculation, in those days, as to where it would terminate on the Ohio. Wheeling had influence enough to secure a branch of it to that place before the natural terminus for this great Western road, on that river, was fixed at Parkersburg. In the spring of 1828, an act of Congress made the United States a stock-holder in the Chesapeake and Ohio Canal for one million dollars. These movements, and other contemplated facilities for transportation, gave a new impetus to business in the West. Previous to this, the National Turnpike Road, passing through Wheeling, Zanesville, &c., was the great Western land route.

The length of time required for bringing Eastern quotations to the knowledge of the readers of Western journals is further shown by the New York prices for April 22, 1829, quoted in the Cincinnati Gazette for May 2. These were—For Indian meal, $3.50 to $3.62½ per bbl., and $14 to $14.50 per hhd; for corn, yellow Northern, 54 to 56; white Long Island and Jersey, 54 to 58, and Southern, 70 to 71 cts. This decided preference for Southern maize seems a new feature in New York prices. But in the issue of the same journal for September 5, 1830, Boston prices for September 4, for corn, are quoted at 55 to 61 cts for Southern white and yellow flat, and Northern at 66 cts. per bushel; and New Orleans prices of August 28 at 7 to 7½ cts. for bacon. This, however, was an exceptional case.

In the interval between December 31, 1829, and January 9, 1833, an imperfect file of thirty Gazettes for the Country shows some eleven quotations of Cincinnati prices, viz: Of corn, beginning with 25 cts. per bushel, and ending with 31 cts—the lowest being 20 and the highest 40; three quotations of cornmeal, for the year ending December 30, showed a range of 28 to 37½ cts. per bushel; nine of pork by the barrel, from December 9, 1830, to January 9, 1833, placed mess at $9 to $10; prime at $8 to $9; cargo at $5 50 to $6 50; clear pork being once quoted at $11. In eleven quotations, city bacon hams, by the pound, ranged from 6 to 8 cts., and hog round fell from 6½ to 4½ cts, and lard rose, in nine months, from 4½ to 8 cts, and gradually declined to 6. In three quotations for the year ending December 9, 1830, country hams were 5 to 6 cts., shoulders 3 to 6, and middlings 6 to 6½ cts. per lb. The lowest ratio in the above interval of the value of the maize bushel to that of mess pork barrel was 1 to 50, and the highest 1 to 25. Live hogs sold, in December '29, at $1.75 to $2.50, and in January '33, at $3 to $3.37 per 100 lbs.

The Saturday Evening Post quotes Philadelphia prices for July 8, 1836—Cornmeal, $4.00 per bbl., $18 to $19 in hhds. Corn, L. C. white at 73 to 75 cts; L. C. yellow at 78 to 80 cts., and U. C. round at 83 to 85 cts. Does L. C. and U. C. mean Upper and Lower Canada?

The Cincinnati Gazette, in April, 1837, had a quotation for the Queen City of 40 cts. for corn; 7½ to 8 cts for lard; $18 to $19 per bbl. for clear pork; $16 to $17 for mess; $14 to $15 for prime, and bacon hams 10 to 12½ cts. per lb. The maize and mess pork ratio here would be as 1 to 41.

Boston quotations, as compared with those of other great Eastern cities, have less interest in the Western maize growing regions. A few from 1839 to 1850 may suffice here:

1839, June 5, (Mercantile Journal)—Corn, Southern flat yellow, 95 to 96 cts. per bushel; Southern flat white, 90 to 91. Cornmeal, kiln dried $4.25 to $4.37½ per bbl. Pork, extra clear, $27 to $28; clear, $26 to $27; prime, $18 to $19 per bbl. Lard, 13 to 13½ cts. per lb.

1840, September 30, (Boston Journal)—Corn, Southern, 61 to 62; Southern white, 57 cts. Kiln dried meal, $3.12 to $3.25 per bbl. Mess pork, (bbl.), $15 to $15.25; extra clear, $16.50 to $17; clear, $16 to $16.50; prime, $13.50. Lard, 12½ cts. per lb.; hams, 11¼ to 12.

1840, October 12, (Journal)—Corn, Southern yellow, 61 cts; do. white, 55 cts. per bushel. Cornmeal, same as on Sept. 30th. Pork, lard and hams, same.

1844, November 13, (American Republican)—Corn, Southern white, 47 to 48 cts. Meal, (bbl.), $2.62 to $2.75. Pork, clear, $10 to $10 50 per bbl.; mess, $9 to $9 50. Lard, Southern and Western, 5¼ to 6½ cts. per lb. Hams, Boston, 7 cts.; Southern and Western, 5 to 6½ cts

1850, August 15, (Evening Traveler)—Corn, Northern, 71 to 72 cts; Southern yellow flat, 68 cts.; do. white, 65. In-

dian meal, \$3.12 to \$3.25. Pork, extra clear, \$13; clear, \$12.50.; mess, \$10 75 to \$11.25; prime, \$9 to \$9.25 per bbl. Lard, 7 to 7½ cts. Hams, Boston, 9½ cts.; Southern and Western, 8½ to 9 cts. per lb.

In contrast with these, we will add New Orleans quotation:

1839, May 21. New Orleans (from Missouri Republican). —Corn in the ear, 90 cts. per bbl.; shelled, in sacks, 65 to 68 cts. per bushel. Pork, clear, \$23 to \$24 per bbl.; mess \$22. M. O., \$19 50 to \$20.; prime, \$18.; P. O., \$16.50 to \$17; bulk pork, 7 to 7½ cts. on levee. Bacon hams, 10½ to 11½ cts. per lb; canvassed, 11½ to 12 cts. Shoulders, 7½ cts. Middlings, 9½ to 10 cts. Lard, 10 to 12 cts.

The following tables are, in part, averaged from the quotations in the leading journals of the great cities. Different cities have different styles of quotation, which have changed from time to time. It will be seen that, in the North-eastern cities, the leading classes of maize quoted are Northern and Southern white and yellow. After the great facilities for transportation were attained, Western came in for a large share, and the qualities were often distinguished by numbers. The differences between ear and shelled were pointed out, and mixed was a more common designation for the color. In New York quotations the mode of conveyance was often made a part of the description, as by sail, by steamer, &c.

In cities where speculation in grain is largely entered into, as Chicago, the difference between the cash down and the prices on time are indicated as seller, March, &c; for winter quotations, &c, September, &c,, for the early dates in August. The condition in which the grain is brought to market is often noted, as damaged, sound and unsound, and the place where it is on sale, as on track, in elevator, at upper or lower depot, &c.

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The Cincinnati prices of corn in 1839 show the favorable results of canal navigation. Special notice was given in the Liberty Hall and Gazette to the movements on the Miami Canal, and reference was made to the Canadian Welland Canal, which completed the chain of lake navigation to Oswego. In the interval between May 16th and Oct. 3d, 1839, corn, at Cincinnati declined from 60 to 50 cts. per bushel, and mess pork from $21 to $13.75 per bbl. Corn-meal, in September, was 75 to 80 cts per bushel. Bacon fluctuated less. Hams ranged from 9 to 11 cts., except sugar-cured (14 cts).

The Gazette of September 19 quotes corn at Cincinnati, 59 to 60 cts. for September 17; at New Orleans, 52 to 62½ cts. for September 4; at New York, 78 cts. for September 12, and at Boston, 80 to 86 cts. for September 11.

The prices of mess pork in New York City, for the five years, respectively, ending 1827, were $13.31; $13.78; $13.83; $11.55, and $13.21 per bbl. Five years ending 1832, $13.71; $12.79; $13.64; $14.30, and $13.77. Five years ending 1837, $14.97; $14.29; $16.96; $23.13, and $21.66. For the five years ending 1842, $21.97; $19.32; $15.07; $11.36, and $9.27. Five years ending 1847, $10.32; $9.28; $12 13; $10.50, and $15.00.

PRICES CURRENT OF AMERICAN MAIZE AND PROVISIONS IN ENGLAND. (SEE U. S. P. O. REPORT, 1844.

Indian corn, duty paid, per 480 lbs	£ 1 10s to £ 1 12s
Pork, U. S., prime mess, in bond, per bbl	£ 2 6s to £ 2 10s
" " " in bond, "	£ 1 17s to £ 2
" Canadian prime mess, in bond, "	£ 2 10s to £ 2 14s
" " " in bond, "	£ 2 4s to £ 2 6s
" " middles, tierces, duty p'd per 336 lbs.	£ 5 10s to £ 5 16s
Hams, dry in bond, per cwt	£ 1 8s to £ 2
Lard, fine leaf, in kegs, duty paid, per cwt	£ 2 2s to £ 2 6s
" Secondary, in bbls " "	£ 1 16s to £ 1 18s
" Inferior " "	£ 1 12s to £ 1 14s
Lard oil, duty paid, per ton	£42 to £43

The following statement of comparative prices in New York and Liverpool is from U. S. P. O. Report, 1847:

Indian corn with 7 per cent. exchange, and sterling freight, 5 per cent. primage, gives the estimate below. To cover cost and charges of purchase in New York and sales in Liverpool, prices in New York for 56 lbs.,

at	45	cts.,	require	sales in	Liverpool	at	30s	2d	per 480 lbs
"	50	"	"	"	"	"	32s	1d	"
"	55	"	"	"	"	"	34s	1½d	"
"	60	"	"	"	"	"	36s	3d	"
"	65	"	"	"	"	"	38s	4d	"
"	70	"	"	"	"	"	40s	6d	"
"	75	"	"	"	"	"	42s	8d	"
"	80	"	"	"	"	"	45s		"
"	85	"	"	"	"	"	47s	3d	"
"	90	"	"	"	"	"	49s	6d	"
"	95	"	"	"	"	"	51s	9d	"
"	100	"	"	"	"	"	54s		"

If freights ranged from 10d., with 5 per cent. primage, to 2s. for imperial bushel, from 9½d. to 12s. added per 480 lbs., to above.

PRICES CURRENT OF AMERICAN PRODUCE AT LIVERPOOL, JANUARY 3, 1845, (FROM U. S. P. O. REPORT, 1844).

Hams in canvass, per cwt	£1 10s to £2 6s
Indian corn, duty paid, 480 lbs	£1 11s to £1 13s
Lard, fine leaf, in kegs, duty paid, per cwt	£2 4s to £2 6s
" " in barrels, " "	£1 17s to £1 18s
" inferior " " "	£1 13s to £1 16s
Pork, thin mess, per bbl	£2 10s to £3
" mess, "	£2 2s to £2 4s
" prime "	£1 16s to £1 18s
Aggregate average price of foreign grain for six weeks, to December 21, 1844, Indian corn	32s

Compare this with the following prices in New York for the years 1864-5, and in England July, '64.

	1860	1861.	1862.	1863.	Jan. '64.	July, '64.	En 64
Cornm'l bl	$ 3.80	$ 3.15	$ 3.00	$ 4.00	$ 5.65	$ 8.00	----
Corn, bu.	95	72	64	82	1.30	1.68	85
Pork, mess	16.25	16.00	12.00	14.50	19.50	42.50	----
" prime	11.75	10.50	8.50	12.50	14.50	35.00	----
Hams, lb	9	8	6	8	11	17½	19
Should. lb.	--	5½	4¾	5¾	8½	15	----
Lard, lb.	10	10⅜	8⅝	10	13	19½	13

Mr. Cist, in his article in U. S. P. O., 1847, on the hog crop of the United States, says of the different classes of cured pork, packed in barrels, that they are made up of the different sizes and conditions of hogs—the finest and fattest making clear and mess pork, while the residue is put up into prime pork or bacon. "The inspection laws require that clear pork shall be put up of the sides, with the ribs out. It takes the largest class of hogs to receive this brand. Mess pork—all sides, with two rumps to the barrel. Prime—for this, pork of lighter weight will suffice; two shoulders, two jowls, and sides enough to fill the barrel make the contents. Two hundred pounds of meat is required by the inspector, but 196 lbs. packed here, it is ascertained, will weigh out more than the former quantity in the Eastern or Southern markets. The mess pork is used for the commercial marine and the United States Navy." "The prime is packed for ship use and the Southern markets. The clear pork goes out to the cod and mackerel fisheries." Bulk pork, for immediate use, was sent off in flat-boats for the lower Mississippi, but the great mass was sent into the smoke-houses, each of which cured from 175,000 to 500,000 lbs. at a time. There the bacon was kept till wanted for shipment, and then packed in hhds. containing 800 or 900 lbs, "the hams, sides and shoulders put up each by themselves."

XXIII.

MONTHLY PRICES OF INDIAN CORN AT NEW ORLEANS, FOR THE FOLLOWING YEARS:

	1843. Cts.	1844. Cts.	1845. Cts.	1846. Cts.	1847. Cts.	1848. Cts.
January . .	-------	36 to 38	37 to 38	55 to 63	55 to 67	54 to [illegible]
February .	-------	32 to 33	38 to 40	40 to 50	80 to 90	40 to 55
March . .	-------	35	40 to 41	47 to 52	75 to 90	36 to 42
April . .	-------	40 to 42	35 to 36	42 to 50	80 to 95	30 to 38
May . .	-------	40 to 41	35 to 38	40 to 50	55 to 70	22 to 28
June . .	-------	33 to 35	28 to 32	35 to 40	65 to 80	32 to 36
July . .	-----	40 to 43	30 to 34	25 to 32	65 to 75	33 to 39
August .	----	40 to 45	34 to 36	30 to 35	40 to 50	36 to 42
September .	42 to 43	43 to 44	40 to 42	36 to 40	50 to 55	-------
October .	37 to 40	40	35 to 38	60 to 65	50 to 75	-------
November .	34 to 35	43 to 45	45 to 50	58 to 75	41 to 50	-------
December. .	43 to 45	31 to 37	80 to 82	60 to 70	45 to 50	--- -

The above was taken from U S. P. O. Report, 1848. The prices are for corn in sacks. This is frequently the character of the St. Louis quotations, which are so intimately connected with the Southern Mississippi trade.

The monthly prices at New Orleans of mess pork and other hog products, for a portion of the interval covered by the above table, will be found in the same volume. Mess pork, in September, 1846, was \$8.75 to \$8.87½ per bbl., and in January, 1847, was a little higher, (\$9.12½ to \$9.50. It rose suddenly to \$14 and \$14 50 in February, and then gradually to \$16.25 and \$16.50 in July; after which, it gradually declined to \$8.16 4-6 and \$8.37½ in May, 1848; rising again to \$10 in August following. Texas was annexed in 1845, and the Mexican War came off in 1847.

For many years New Orleans received a large portion of the Western trade.

The following will give some idea of the earlier movements of Indian corn Eastward:

XXIV.

COMPARATIVE PRICES OF MAIZE IN CENTS, AT ST. LOUIS, CHICAGO, CINCINNATI, BUFFALO AND NEW YORK, FOR THE FOUR QUARTERS OF 1848. (SEE U. S. P. O. REPORT, 1848).

	FIRST.		SECOND.		THIRD.		FOURTH.	
	Northern.	Southern.	Northern.	Southern.	Northern.	Southern.	Northern.	Southern
St Louis	----------	23½ to 25½	----------	17⅔ to 19	----------	24 to 25⅔	----------	29 to 32
Chicago	33	----------	37	----------	30 to 33	----------	32½ to 35	----------
Cincinnati	24 to 28	----------	25 to 28	----------	29⅓ to 33⅓	----------	27⅓ to 31⅔	----------
Buffalo	----------	----------	39	----------	44½	----------	47	----------
New York	63 to 67⅔	59⅓ to 64	56 to 57⅔	52⅓ to 55	60 to 66	56⅔ to 61	65 to 74	65 to 70

The prices are seen to diminish as the markets recede from New York. Shippers of this grain at Chicago could afford to give rather more than those at Cincinnati, because the lakes, the Erie Canal and the Hudson River formed a more complete water communication with the great centers than that by the Miami Canal, Lake Erie, &c.

XXV.

STAPLE MONTHLY PRICES OF INDIAN CORN AND CORN-MEAL IN NEW YORK CITY, FROM THE U. S. REPORT ON COMMERCE AND NAVIGATION, IN THE FOLLOWING YEARS:

INDIAN CORN PER BUSHEL.

Months.	1864.	1865	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.
January	$1 27½@1 29	$1 86@1 88	$ 90@ 95	$1 15@1 17	$1 38@1 44	$1 06@1 10	$1 09@1 14	76 @82	76@80	60 @66½
February	1 21@1 23	1 73@1 78	84@ 87	1 09@1 12	1 24@1 25	1 00@1 02	92@1 08	85 @86	71@80	64 @67
March .	1 35@1 37	1 89	75@ 82	1 07@1 09	1 25@1 28	1 00@1 03	90@1 05	83 @86½	69@75	63 @65½
April .	1 28½@1 29	1 60@1 70	80@ 81	1 20@1 23	1 21@1 25	90@ 95	1 07@1 11	82 @83½	70@71½	63 @66
May . .	1 38½	1 45@1 50	77@ 84	1 36@1 42	1 13@1 15½	86@ 90	1 10@1 16	79 @81	75@77	67½@70
June .	1 56@1 58½	90@ 96	74@ 82	1 20@1 28	1 11@1 17	94	1 06@1 12	68	66@71	47 @68
July . .	1 52@1 53½	80@ 85	85@ 90	1 05@1 12	1 00@1 04	1 00@1 02	92@1 00	72 @73	60@63	48 @56
August	1 57@1 59½	84@ 89	79@ 80	1 00@1 12	1 05@1 13	1 00@1 14	95@ 98	65 @66	60@64	49 @56
September	1 58@1 60	86@ 92	78@ 81	1 12@1 18	1 16@1 23	1 12@1 20	83@ 86	65½@66	62@64	62 @66
October	1 60	87@ 95	94@ 96	1 30@1 35	1 15@1 18	90@1 04	86@ 88	74½@76	63@65	61 @66
November	1 67@1 68	78@ 91	1 25@1 27	1 37@1 39	1 13@1 16½	97@1 04	80@ 88	76 @78	64@66	60 @61
December	1 95	90@ 96	1 20@1 23	1 32@1 35	1 12@1 17	1 09@1 12	77@ 87	76 @80	63@65	73 @77

XXVI

CORN-MEAL PER BARREL.

Months.	1864.	1865	1866.	1867.	1868.	1869.	1870.	1871	1872.	1873.
January	$5 30@5 70	$7 75	$4 25@4 60	$5 00@5 30	$6 15@6 50	$4 25@5 50	$4 75@5 20	$4 00@4 50	$3 65@4 10	$3 25@3 60
February	5 30@5 60	8 00@8 20	4 00@4 50	5 00@5 40	6 00@6 40	4 00@5 02	4 60@5 00	4 20@4 70	3 50@3 90	3 40@3 65
March .	5 30@5 35	7 50@8 40	3 80@4 40	5 10@5 50	6 00@6 30	4 00@5 00	4 50@5 00	3 85@4 60	3 50@3 90	3 25@3 60
April .	5 60	5 75@6 25	3 60@4 15	5 40@6 00	5 85@6 25	4 10@5 05	4 50@5 20	3 80@4 45	3 50@3 85	3 20@3 50
May . .	6 00@6 50	5 75@6 75	4 00@4 40	6 35@7 00	5 75@6 35	4 20@4 75	4 75@5 75	3 70@4 30	3 60@3 85	3 20@3 40
June .	6 90@7 00	4 40@5 65	4 35@4 75	5 90@6 25	5 40@6 35	4 00@4 60	5 25@5 75	3 40@4 20	3 50@3 75	3 20@3 40
July . .	8 00@8 50	4 65@5 15	4 75@5 25	5 50@6 00	5 25@6 15	4 00@4 75	5 20@5 65	3 40@4 15	3 25@3 40	3 00@3 30
August	8 00@8 35	5 25@5 75	4 50@4 90	5 50@6 50	5 25@6 20	5 25@6 25	5 40@5 25	3 70@4 25	3 20@3 50	3 10@3 35
September	8 00@8 50	5 00@5 60	4 50@4 90	5 85@6 50	5 75@6 75	5 00@6 00	5 00@5 75	3 50@4 00	3 25@3 60	3 00@3 40
October .	8 00@8 50	4 90@5 20	5 00@5 25	6 35@7 10	5 40@6 40	5 00@6 00	4 25@5 15	3 90@4 40	3 25@3 60	3 20@3 60
November	7 25	4 50@4 85	6 00@6 25	6 65@7 50	5 25@6 15	5 00@5 75	4 50@5 10	3 85@4 40	3 25@3 60	3 20@3 60
December	8 50@8 75	4 25@4 75	5 75@6 00	6 10@6 65	4 75@5 75	4 75@5 25	4 00@4 60	3 75@4 15	3 25@3 60	3 60@3 75

MONTHLY PRICES OF HOG PRODUCTS AT NEW YORK CITY, FROM U. S. REPORT ON COMMERCE AND NAVIGATION.

XXVII.

MESS PORK PER BBL. (DOLLARS).

	1864.	1865.	1866.	1867.	1868.
Jan.	$19 75 @20 00	$36 00@36 50	$27 75 @28 25	$20 00@20 75	$20 90@21 15
Feb.	19 12½@22 25	34 50@35 50	27 75 @28 00	19 50@20 00	20 60@20 75
Mar.	21 00 @23 50	33 00@34 00	28 00 @28 12½	20 50@21 10	22 70@23 00
April	22 25 @24 25	25 50@26 50	25 87½@26 00	23 25@23 75	20 75@21 25
May	26 00 @28 75	25 50@26 00	28 62 @29 00	23 00@23 25	23 00@23 75
June	29 75 @30 00	21 00@21 50	30 25 @30 50	23 00@23 25	23 75@24 00
July	34 00 @37 00	23 50@24 75	31 50 @32 00	22 00@22 50	27 65@27 75
Aug.	35 00 @36 00	29 00@35 00	31 25 @31 75	23 50@23 75	24 00@25 00
Sept.	37 50 @38 00	29 50@30 50	32 50 @33 00	24 50@25 00	25 75@26 00
Oct.	38 00 @38 50	31 00@34 25	33 00 @33 50	23 75@24 00	21 00@25 00
Nov.	40 50	33 62@34 12	32 50 @35 00	21 00@21 75	23 50@26 50
Dec.	36 00	28 00@28 50	21 50 @22 00	21 50@21 85	25 50@25 87

	1869.	1870.	1871.	1872.	1873
Jan.	$26 50 26 75	$29 50@30 00	$20 00@20 50	$14 00	$14 75
Feb.	26 00 27 50	26 50@26 75	22 87@23 00	14 50	14 05@14 37½
Mar.	28 50 30 00	26 25@26 50	22 00@22 12½	14 00 @14 05	14 25@15 37½
April	28 75 30 00	27 00@27 25	20 00@21 37½	13 37½@13 50	17 00@17 25
May	28 50 29 00	25 50@25 75	17 00@17 25	13 85	18 50@19 00
June	28 00 28 25	20 75@29 87	15 50	13 25 @13 30	19 00@20 00
July	28 00 29 00	29 25	14 62½14 87½	13 25 @13 30	16 20@16 50
Aug.	30 00 30 50	29 00@30	13 50@13 62½	12 25 @12 50	15 00@15 25
Sept.	30 50	30 00@32 00	13 50@13 75	13 50 @14 00	17 75
Oct.	33 00	23 50	13 50@13 62½	14 00 @14 25	17 00@17 12½
Nov.	24 50 25 50	24 00@24 25	13 25	14 50 @14 75	18 00@19 00
Dec.	23 75 24 00	22 00@22 50	13 25@13 50	14 00 @15 00	17 00@17 50

XXVIII.

PICKLED HAMS PER LB. (CTS).

	1864	1865.	1866.	1867.	1868.
Jan.	12 @12½	19 @21	13½@16	10 @12	11¾@13
Feb.	11 @12½	18 @22	16 @18	10 @11¼	12 @13
Mar.	11½@13½	18½@21	17 @18½	11 @13	12 @13½
April	13 @14½	1[illegible]½@16½	16½@18	13½@14½	14½@15⅞
May	15½@16	17 @19¼	16½@17¾	12 @13½	17½@18¼
June	14½@14⅝	13 @17½	17 @19	12½@14½	16¾@17½
July	17½@18	17 @19	11½@20	12 @14	15½@17
Aug.	17	21 @24½	18 @20½	12 @15	17 @19
Sept.	18 @18½	19 @23	19½@21¼	15 @16½	16½@18½
Oct.	18 @20	19½@23	17½@18½	16 @18	17 @18½
Nov.	17½@21	20 @23½	17 @19	15 @17	17 @19
Dec.	18 @21	16½@19½	12½@13	11¾@13	16 @17

	1869.	1870.	1871.	1872.	1873.
Jan.	13 @16	16	10 @13	9 @ 9½	9 @10½
Feb.	18 @18¼	14½@15½	13½@15	9 @ 9½	10 @10½
Mar.	19 @20½	14 @14¾	14 @15½	8¾@ 9¾	11 @12⅜
April	18 @20	14½@16	13 @14	8½@ 9¼	11¼@13
May	18 @19	16½@17	11¼@13	9½@10¼	11¼@13
June	15 @19¼	16 @17	10 @12	9¼@10½	11¼@12
July	16½@20	16½	10 @13	11 @13	12½@13½
Aug.	17 @19	24	12½@13¾	13 @13½	13
Sept.	17 @19	19 @21	10 @12½	13½@14	13 @14
Oct.	17 @19	19 @20	12 @12½	14 @14½	10½@11½
Nov.	17 @19	17 @19	12 @12½	13½@14½	8½@ 9½
Dec.	17	19 @20	10 @11	8½@ 9½	8½@ 9½

XXIX.

PICKLED SHOULDERS, PER LB. (EXCEPT 1866—BACON) CENTS.

	1864.	1865.	1866.	1867	1868.	1869.	1870.	1871.	1872.	1873.
January	7 @ 8½	17¼@18½	15 @16	9 @10	8 @ 9	10½@11½	12 @12½	7 @ 8½	5 @ 6	5 @ 5¼
February	8 @ 9¼	17 @18½	14½@15¼	8½@ 9½	8 @ 9¼	14 @14½	11½@12	7¾@ 9	5 @ 5¾	5¼@ 6½
March	9⅜@10	17 @18	15½@16	9 @10	10½@11¾	15½	10⅝@12	8¼@ 9	5 @ 5½	7 @ 7¼
April .	9⅜@10½	14½@15½	14¾@15¾	9½@10½	10½@11½	15	10¼@12	8 @ 8½	5 @ 5½	7 @ 7½
May .	11½@12	14½@15½	14½@15¼	8½@ 9½	13½@13¾	12½@15	11½@12½	6½@ 7	5½@ 6¼	7½@ 7¾
June .	11¼@11½	11½@13½	14½@16¼	8¾@10¼	12½@13½	12¾@16	12 @18	6 @ 6¾	5⅛@ 5½	7¼@ 7¾
July .	14¾@15½	12 @14	15 @17½	9 @10	12 @13	13½@16½	12 @12¾	5¾@ 6	5¼@ 5¾	7½@ 8
August	15	16 @17½	15 @16	11½@12	13 @13½	14¾@15	12 @12¾	5¾@ 6½	6 @ 6⅞	9 @ 9¼
September	16¼	14½@16½	14½@15	12 @12½	13½@14	14¾@15½	12 @12¾	5¾@ 6	8⅞	8¼@ 8⅜
October	17 @18	16½@17½	14 @15	12 @13	11½@12¼	14¾@15½	12 @12¾	7	7	7½@ 7¾
November	16½@18½	15 @17	15 @16	11½@12¾	11 @11½	14¾@15	12 @12¾	6¼@ 7	7	7 @ 7½
December	17 @19	13 @14½	15 @16½	8 @ 9	10 @11	12 @12½	12 @12¾	5½@ 6½	5¼@ 5⅜	6 @ 6½

XXX.

LARD (WESTERN) PER LB., CENTS.

	1864	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873
January	12½@12⅝	20½@24¾	15½@18½	11¾@12½	12¼@13⅛	16½@17¾	16½@18½	12¼@12½	9⅜@ 9¾	7¾@ 8¼
February	12⅞@13⅛	18¾@23	14¾@17½	11¾@13¼	13 @13⅝	19¾@21⅛	15½@17½	13 @13½	9½@ 9⅞	8 @ 8⅜
March	13¼@14	20 @24¼	17 @19¼	11¾@13	14⅞@15¾	17½@19⅛	14 @15	13 @13½	9⅜@ 9⅞	8¼@ 8⅝
April .	13 @13¾	15½@18	16 @18½	12 @14½	15½@16½	17½@18¾	14 @15½	12⅝@12⅞	8¾@ 9¼	8½@ 8⅞
May .	14 @14¾	15½@18¼	18 @21¼	12 @13½	18⅛@19	17 @18¾	16⅝@16¾	11¼@11⅝	8⅞@ 9⅝	9⅛@ 9¾
June .	14 @14½	15 @18¼	19 @22½	12½@13⅝	16½@17¼	17½@19½	15 @16½	10½@10⅝	8¾@ 9½	8½@ 8¾
July .	18½@18¾	15½@19½	19½@21¼	11¾@12¾	15¾@17⅛	17½@20	14 @16⅜	10⅜@10½	8½@ 9¾	8½@ 8⅞
August	20 @20¼	20 @24	18 @20½	12½@13¾	16¼@18½	17¼@20	16 @19⅞	10⅛@10⅜	8⅝@ 9⅛	8¼@ 8¾
September	22½@23½	19¼@24⅝	18½@20¾	12¼@14	18¾@19¾	17¼@20	16½@17¾	9⅝@ 9⅞	9¼	8¼@ 8⅞
October	18¼	25 @29½	16½@18½	14 @15	18 @20	16¾@19	14⅛@16¼	10¼@10½	8¼@ 9	8⅜@ 8½
November	21 @21¼	24 @28½	14 @16	13 @13½	15 @17⅜	16¼@18	14⅞@15⅛	10 @10¼	8⅜@ 9¼	7⅜@ 8
December	21¾@22	18 @23	12 @13½	12½@13	14 @15⅞	18¼@20	13 @13¾	9⅝@10	7⅞@ 8½	8 @ 8¼

Corn rose rapidly from January to October, in 1864 and as rapidly declined in 1865 and 1870. Cornmeal rose from January to October in '64 and '66, and fell from January to December, in '65. The meats took the same course as corn in 1864, but their changes were more varied in the other years of the above table.

The prices of gold during the years 1862–5, inclusive, had much influence on the prices of maize and hog products. At Cincinnati, on the 2d of January, 1862, the rise to 2 per cent. on gold is said to have "checked sales materially." On the 1st of July it had advanced to 7½@8c. premium, buying; on 2d of October, to 20 buying; on 2d of January, 1863, to 35; on April 1st, it was 50 to 53; July 1st, 43 to 44; October 2, 40 to 42; January 4th, 1864, 50 to 51; April 1st, 1864, 66 to 67; on July 1st, 1864, 260 to 270 were the quotations. October 1st gold was quoted at 190 buying; April 3d, 1865, at 145; July 3d, at 138 to 139½. After July 1st, 1864, when gold attained such an extraordinary height, the quotations above were not stated in the journals from which they are taken, as a premium, but as the price of gold. These prices were nearly the same throughout the States that had not seceded. Similar inflations of the currency had occurred several times before in the history of the Republic. During the dark times of the Revolutionary War, when the credit of the United States was at its lowest, the enormous prices for coffee and sugar, in the Continental currency, are well known. Relief came when Congress took away the legal tender character of its paper and allowed it to pass for what it was worth. In 1837 there was a general crash, after several years of over-trading and extravagant expenditure. In 1857, in May, money was said to be plenty. Prices of corn, on June 13, were high at New York, ranging from 92 cts. to $1.00. Cornmeal sold from $4.10 to $4.50 per bbl.; mess pork from $23.65 to $23.70. Corn declined somewhat in July and August, when an expansion of railroad stocks was noted, and on the 29th of the last month, there was said to be trouble in Wall Street, and many failures. A panic followed soon after, and about the 13th of October the suspension of banks was said to be general. On the 17th of October corn was quoted at 67 to

76 cts., and cornmeal $3.50 to $4. Mess pork held its own for a short time, as it does not generally keep up with the fluctuations of maize; but in falling from high prices, lags behind its neighbor product. The foreign imports became very small. The New York *Chronicle*, from which these quotations are taken, charged the New York banks with loaning $120,000,000 against $10,000,000 of specie in their safes, and stated that the expansion of paper swelled the prices. Mess pork reached its lowest ($14.75) in December, at which time there was said to be a panic in Europe. In the meantime exporting had commenced with vigor, and brought back specie from Europe. This exportation had been made possible by the lowering of prices. Confidence was gradually restored, and stocks, in which the panic commenced, became alive again, but in a more healthy trade. In January, 1859, there was another rush of speculative prices; the American prices rising above those in Europe. On the 24th of February it was noticed that bread-stuffs were going West instead of East. Exports were diminished and importations largely increased.

Wars, both at home and abroad, have had a great effect on the price of maize. Before the civil war, our merchants had invested very largely in shipping for the foreign trade. Their enterprise in this line about the commencement of the century, during the general European War, has already been referred to. Our commerce for a time rode on a great wave of prosperity; we were fast becoming the common carriers for the belligerent nations. The great powers soon took measures to humble us. The ill feeling towards Great Britain especially, in consequence of her insults, did not, however, prevent us from exporting so largely as to swell the prices of maize and other products, only a few months before the War of 1812 was declared. The very imminence of that war probably caused the owners of our shipping to

work fast before the night came. But prices fell with the opening of the war. About the time of the Mexican War, there was an extraordinary exportation of Indian corn and cornmeal; the fertile West then being in a state of rapid development, and fair prices being maintained, yet admitting of competition with foreign producers.

The war of the allies against Austria would necessarily raise prices in Europe, and make it profitable to compete with her grain growers. The prices of maize and cornmeal especially were maintained in New York after peace was restored. In November, 1859, the former rose to $1 per bushel, and the latter to $4.50 per bbl. Examples might be multiplied indefinitely of the disturbing influences of war on prices. But the commerce of peace is much more favorable to the prosperity of a Republic, than that of war. The public mind is less liable to agitation; it is less easy to get up a panic, the recourse of unprincipled speculators. And the commerce between nations at peace with others, is undoubtedly safer, and in the end, more profitable.

Freights, in so large a territory as that of the United States, have a most important bearing on prices. In the central portion of the State of Ohio, for instance, before canals and railroads made the way easy for the transport of produce, the country merchants frequently had their goods wagoned from the place of purchase. The carriers, like the *arrieros* of Spain, were generally honest men, but the transport was often tedious and expensive, and the exchange, directly or indirectly, of an article so bulky for its price, as Indian corn, was often out of the question. The Ohio and Mississippi rivers, however, being navigable when in a tolerable stage, gave ample opportunities for cheap transport, which were open to all; although the danger of collision made them unsafe for small crafts heavily loaded, after steamboating on a large scale became general. The prices

of freights on these rivers was fluctuating, just as it is now on the great lakes, depending on the season and stage of water, as well as on the amount of business. During the earlier years of Western progress, it was much more common than it is now, for farmers living on or near the banks of the Ohio, to combine and send down their produce in flat boats, for sale. A few examples of published freight prices may suffice to show what the common carriers could do to bring the supply and demand nearer together. In March, 1855, pound freight was carried from Cincinnati to Pittsburg for 20 cts. per 100 lbs , and to St. Louis for 35 cts. On April 9th, freights to Wheeling were said to be 15 cts.; to Pittsburg, 20 cts., and to New Orleans, 20 cts. In 1865, when prices of all kinds were high, on April 6th freight to the lower Mississippi declined on account of high water, which enabled the largest class of boats to load to their utmost capacity. To New Orleans, on pork the freight was $1.30, and on other heavy freight 45 cts. per 100 lbs. Pork was higher to Memphis, ($1.50 per bbl.) although other freight was 40 cts. per 100 lbs. It was stated that from Buffalo, in 1853, on June 7th, freight on the Erie Canal, &c. to New York, was 12 cts. per bushel; to Albany, 10 cts. On July 23d, the freight to New York rose to 13 cts. At this date the lake freight on corn, &c. from Cleveland to Buffalo and Dunkirk was 2½ cts , to Oswego 5½ cts.; but on October 12th, that to Buffalo and Dunkirk rose to 4 cts. On 18th of November corn was taken to New York City for 18 cts., and wheat from thence to Europe for 25 to 30 cts.

Cornmeal is generally quoted in the Eastern cities, in the leading journals. The price is more constant than that of corn. In 1842 it was, for the latter half year, between $2.87½ and $3.12½ per bbl., at New York; corn ranging between 48 and 60 cts. and mess pork (by the bbl.) from $7 50 to $9.50. In the third quarter of the same year, corn

at St. Louis was 18 and 20 cts., and mess pork $4.75. In February, 1843, corn at Cincinnati was 16 cts. per bushel, and mess pork $6.62 per bbl.; in November, corn was 18 to 20 cts. Near the beginnings of January, April, July and October, 1843, corn ranged, in New York, between 48 and 58 cts., and mess pork between $8 and $10⅞. Corn was rather lower next year, and mess pork higher; New Orleans quarterly prices being about one-fifth lower still. In 1845, August 28th, corn was 62 cts. at Boston, 57 at New York, and on 30th, 43 cts. at Cleveland; and on September 4th, 35 to 37 cents at Cincinnati, where mess pork was $13.50 to $14.

On September 2d, from Cincinnati to the mouth of the Ohio, by boats, freight was $1 per bbl. for pork, and 50 cts. per 100 lbs. for pound freights. Also, 50 cts. to St. Louis, and from the mouth of the Ohio to New Orleans, 25 cts., being about 14 cents on a bushel of corn. In 1849 (early in January) corn was 30 to 32 at New Orleans, and 45 to 50 at Baltimore, and early in April 23 to 24 at the former, and 46 to 50 at the latter place. In 1850 corn gained from 30 to 91 per cent. in New Orleans, over 1849. In 1853, early in April, July and October, corn was respectively 52 to 54 cts., 50 cts., and 60 to 65 cts at Cleveland; and 62½ to 65, 57½ to 69½, and 84 to 89 at New York. On 9th of April, 1855, the freights from Cincinnati to New Orleans were said to be 20 cts. per 100 lbs., or eleven and one-fifth cts. per bushel of corn.

Quotations early in April (I) and July (II) in 1855, from Cincinnati *Columbian*, &c. for corn (per bush.) and mess pork (per bbl.) were, for

	NEW ORLEANS.		CINCINNATI.		NEW YORK.	
	Corn.	Mess Pork.	Corn.	Mess Pork.	Corn.	Mess Pork.
I —	95c.	$15 00	65@70c.	$14 50	$1 00@1 10	$15 50@15 ⅝
II —	85@95c.	....	70@75c.	18 00@18 50	88@ 92	19 ⅛@19 50

Not long before this the allies and Russians had been fighting before Sebastopol, and a conference was in progress looking towards peace.

Prices early in January, April, July and October for 1864, for a bushel of maize, and barrel of mess pork, ranging as follows, were quoted in Cincinnati daily papers of the respective times.

	ST. LOUIS.		CHICAGO.		CINCINNATI.	
	Maize.	Mess Pork.	Maize.	Mess Pork.	Maize.	Mess Pork.
I –	....	....	$ 81@ 92	$17 75@18 25	$ 90@1 08	$18 75@22 00
II –	$ 92@1 07	$22 50	83@ 89½	....	95@1 07	22 00@22 50
III –	1 30@1 36	....	1 28@1 33	$40 00	1 00@1 10	40 00@44 25
IV –	....	....	1 23@1 24	....	1 20@1 25	40 00@42 00

XXXI.

Quarterly prices in the following cities, selected from the monthly prices in the U. S. Agricultural Reports (intended to show the state of the market at the opening of the months) for the following years. The quarters begin respectively with January (I), April (II), July (III), and October (IV).

		1869.		1870.		1871.	
		Maize. bush. cts.	Mess Pork. per bbl. $.	Maize. bush. cts.	Mess Pork. per bbl. $.	Maize. bush. cts.	Mess Pork. per bbl. $
St Louis	I......	61 @73	28 00@32 00	75 @85	28 50	44 @47	19 00@19 50
	II......	62 @78	30 50@31 50	82 @87	27 00@27 25	50 @57½	20 00@20 50
	III......	80 @108	32 50@34 00	75 @97	30 00@30 25	50 @61	13 50@16 00
	IV......	76 @100	29 50@32 50	64 @69	24 50@25 00	46 @52	13 00@13 25
Chicago.	I......	62 @65	24 00@25 00	69 @72	27 50@27 75	53 @53½	18 00@18 25
	II......	64½@66	25 90@26 25	76 @77½	25 75@26 50	51¼@53¼	20 15@20 50
	III.....	68 @74	27 75@28 25	79 @84	28 00@29 50	51 @53⅜	15 00@15 25
	IV......	70 @77½	....	63 @63½	25 00	45 @47½	13 00@13 12½
Cincinnati	I	65 @66	28 50@29 00	....	27 50	53 @54	19 00
	II......	63	31 50	....	26 50@27 00	57 @59	21 00
	III......	72 @73	32 50@32 75	83 @85	29 75@30 00	55 @59	15 00@15 25
	IV......	93 @94	31 25@31 50	66 @67	24 50@24 75	53 @54	12 50@13 00

St. Louis corn above quoted in 1869, was mixed, and white in sacks; in 1870 was white, yellow and mixed, all in sacks; in 1871, was mixed and yellow. Chicago quotations of corn for 1869 of No. 1, and 1870 No. 2, and for 1871

included another kind. Cincinnati corn No. 1, for 1869; Nos. 1 and 2 for 1870, and No. 1 and new ear for 1871.

Quarterly prices in 1871, selected from the monthly prices in U. S. Agricultural Report, and intended to show the state of the market at the opening of January, April, July and October, in the following cities: (corn, cts. per bushel; pork, dollars per barrel).

BOSTON.		NEW ORLEANS.		SAN FRANCISCO.	
Corn.	Mess Pork.	Corn.	Mess Pork.	Corn.	Mess Pork.
I—82@86c.	$20 50@21 50	69 @70c.	$21 00 @21 50	$1 50@1 60	$24 00@26 00
II—86@91c.	21 50@22 00	65 @70c.	21 00 @23 00	1 60@1 70	25 00@29 00
III—79@82c.	16 00@16 50	70 @75c.	16 12½@16 75	2 00@2 25	25 00@27 00
IV—84@88c.	14 50@14 75	82½@85c.	14 25 @15 00	2 35	20 00@24 00

The kinds here quoted are yellow, white and mixed.

The following quotations for January 30, 1875, were taken from newspapers on file in the Public Library of Cincinnati.

	Corn. bush. cts	Mess Pork. per bbl. $.		Corn. bush. cts.	Mess Pork. per bbl. $.
Boston	85½	21 00@21 50	Pittsburg	57 @78	21 00
New York	83 @84½	new, 19 75	Cincinnati	67 @68	19 00
Philadelphia	77 @78	19 00@20 00	Louisville	65½@70	19 50
Albany	83 @85	22 00	Nashville	72½@85	....
Providence	92 @105	20 00@22 00	St. Louis	60 @64½	18 00@18 75
Detroit	67	19 00@19 50	do in sacks	64 @72	... .
Montreal	....	22 00@23 00	Memphis	83½@85	21 00@21 50
Cleveland	68 @70	....	New Orleans	85	20 00
Indianapolis	60 @65	....	Mobile	95 @1 03	20 00@21 00
Chicago	61 @65¾	18 50@19 33	Galveston, Texas	80 @1 05	....
Milwaukee	60 @60½	18 20@18 25	Jacksonville, Fla.	1 20@1 30	....
St. Paul	65 @70	18 00@21 00	Atlanta, Ga.	....	19 62½
Des Moines	43 @46	....	Wilmington, N. C	1 20@1 25	20 00
Leavenworth	60 @65	20 00	Richmond, Va.	76	19 00@19 50

San Francisco, (January 29th) Lard, per lb. .... 15 to 17½ cts.

Cornmeal is quoted, January 30th, 1875, at Detroit, $27 to $30 per ton; at New Orleans, $4 per bbl.; at Memphis, $3.85 to $4.10 per bbl.; at Nashville, 85 to 90 cts. per bushel; at Richmond, Va., 85; at Wilmington, N. C., $1.25 to $1.30; at Leavenworth, Kansas, $1.80 per 100 lbs., and Louisville at $1.55 to $1.65 per same; at Portland, Oregon, 4 to 5 cts. per lb.; at Galveston, $5 to $5.25 per bbl., and at Jacksonville, Florida, $5 to $6.50 per bbl.

XXXII.

PRICES FOR MAY AND JUNE, 1876, FROM MONTHLY REPORT OF DEPARTMENT OF AGRICULTURE, SHOWING THE STATE OF THE MARKET AT OPENING OF EACH MONTH.

		Corn, per bu.	Pork, per bbl.			Lard, lb.	Swine, 100 lb
			Mess.	Prime mess.	Prime.		
St. Louis	May	$ 41 @ 50	$23 00@23 50	$..................	$..................	11½@13¾	$ 7 20@ 7 55
	June	39 @ 44½	23 00@23 50	....	....	11½@13¾	5 40@ 5 90
San Francisco	May	1 05 @1 15	22 00@24 00	17 50@18 50	....	13 @15	....
	June	1 05 @1 15	22 00@24 00	17 50@18 50	....	13 @15	....
New Orleans	May	57 @ 68	22 00@22 75	....	....	13½@14¾	6 00@ 8 50
	June	63 @ 70	22 50@22 75	....	....	13 @14¼	6 00@ 8 50
Chicago	May	45¼@ 46	20 45@20 60	20 00	16 00	12½@13	7 25@ 7 65
	June	44½@ 45	17 80@17 90	....	13 00	10¾@11⅛	5 80@ 6 35
New York	May	60¾@ 61½	21 45@21 70	17 50*	....	13 @13⅓	....
	June	40 @ 59¼	18 80@19 25	....	....	10¾@11½	6 90@ 7 00
Boston	May	62 @ 65	22 50@22 75	....	19 00@19 50	14 @14¾	....
	June	61½@ 65½	21 00@21 50	....	17 50@18 00	13¼@13½	....
Cincinnati	May	45 @ 51	20 50@21 50	....	....	12 @13¼	6 00@ 7 35
	June	38 @ 47	18 50	....	....	10⅜@12½	5 25@ 6 00
Philadelphia	May	60 @ 62	22 50	18 50@19 00	18 50@19 00	13 @13¾	11 00@12 25
	June	57 @ 59	20 50	18 00	17 00	11¼@16½	10 00@10 50
Baltimore	May	53½@ 62	22 25@22 50	....	21 25	13¼@14	9 75@11 00
	June	53 @ 57	20 00	....	19 00	12½@13	8 50@ 9 25

* Extra mess.

At Liverpool, England, on January 30th, 1875, Indian corn was quoted at 36s to 39s per quarter (480 lbs), and pork at 82s. Freights on same date, on corn from Detroit to Albany, 25 cts.; to New York and Philadelphia, 30 cts., and to Boston and Portland, 35 cts. From Milwaukee, same date, freights to Liverpool, 92½ cts.; to Cincinnati, all rail, 30 cts.; to Cleveland, all rail 22½ cts.; to New York, all rail, 40 cts., and to Philadelphia and Baltimore 35 cts.

The discussion of the principles which lie back of maize prices, in connection with a wider range of facts, will be less difficult, when the varieties, uses and modes of culture of this grain have been considered.

The supply depends on the fertility of the ground planted, whether natural, or artificially produced; on the number of acres; the conditions of the season, as, favorable or otherwise for planting, after cultivation, ripening and harvesting; on the force used, by hand or machinery, and its timely application; on the skillfulness of the general farm management; on the care taken and the efficiency of the means used for the preservation of the crop; and on the absence of disturbing and destructive forces during cultivation; and on other conditions.

The demand depends on the facilities for cheap and rapid transportation; on the numbers, habits and tastes of the population among whom it is distributed, and the increase of that population, by immigration or otherwise; on the diversity of uses, old and new, to which the product is applied; on the abundance or shortness of this or other crops, at home or in foreign lands; on the variety of industries and their changes, the widening fields of labor, and especially on successful movements in new and great enterprises. The demand is also seriously affected by political movements, panics, impending dangers, and excessive speculation, developing "corners" and other similar attempts to grasp extraordinary profits.

In looking back to the early years of the Republic, we see how rapidly the cause of the industries has made its way to prominence in the great channels that bring the old and new to the eyes of the masses; how the leading journals, which were once filled with matters of war and politics, are now so largely devoted to the interests of private workers, organized or independent. And here is the hope of our country; for, although war is still enthroned, peace is the power behind it. It was contempt for the private industries, and the filling up of the capital with the spoils of war, that ate out the heart of Roman freedom. The Roman Republic gained the world, and lost its soul.

EXPORTS OF MAIZE AND SWINE PRODUCTS.

In the early times of the West, it was not uncommon for the hill farmer, who lived ten or twelve miles from town, not only to provide sustenance for his family off of the farm, but with their co-operation, to manufacture their clothing, and put up the buildings. Hence the hatchelling machine, the spinning wheel, and the loom—and sometimes the carpenter's bench—were nearly as important at the homestead as the plow or wagon. For the making or mending of these he could pay in trade; and for most of his other implements, if he only found the iron and steel. He could, being his own butcher, supply the tanner with the raw material for the leather, which, in the hands of the saddler, harness and shoemaker, who needed his flour and meat, became trappings for the horses, and clothing for the little feet, when they did not go bare. Other arrangements in the way of trade made the circulating medium a very small part of his financial affairs. Still he had his taxes to pay, and sometime his iron and nails, his buttons, queensware, and knives and forks to buy; and his dear ones were generally fond of tea and coffee, which

could not always be obtained in exchange for butter and eggs. Then there was the remainder of the debt for the farm, or the land out of which it was made, which was generally paid in cash.

Now, that noted farmer, U. S. (who, for a considerable length of time, went under a nick name with these initials) when he became of age and assumed his freedom, was placed in such circumstances, with reference to his neighbors across the water, that he did not see fit to follow out this programme exactly. He became a trader, and was a very bold and skillful one; and though the main part of his capital was real estate, yet such was the extent of the business he acquired, that the want of floating capital was not immediately felt. He had considerable farm stuff to dispose of, and among the rest, Indian corn, pork, bacon and lard, packed by himself; he shipped them to islands and coasts where they were most wanted, and exchanged for foreign produce and manufactures. Part of these he carried round and sold to neighbors too intent on a great quarrel to do this carrying with advantage for themselves. The business for a time was a great success; but the quarrel growing hot, measures were taken to starve each other out, by stopping the operations of the common carrier. This bore hard on the sale of farm products, as well as on the trading business, and in time involved the operator in the quarrel, and it cost him a heavy sum to get out of it.

It was soon found necessary to fall back somewhat into the line of the Western farmer, who manufactured his own linsey and tow linen, and made his own axe handles.

This brief narrative is illustrated by the following statement of U. S. exports of Indian corn, and swine products, since the birth of the nation which has now acquired the title of the "Great Republic." Previous to 1790, and after the declaration of independence, the exports of a few lead-

ing cities are given (in U. S. P. O., 1853): from Portsmouth, N. H. 2.510 bushels in 1776; 1,915 bushels in 1777; 5,306 in 1778; 3,097 in 1779; 6,711 in 1780; and 5,587 in 1781.

The following table of Domestic Exports of the United States is made up of extracts from U. S. Documents, and Seybert's Statistical Annals, (published in 1818) commencing on the 1st of October, 1789, and ending on September 30th, 1820.

XXXIII.

Year	Corn. bushels.	Cornmeal bushels.	Hams & Bacon. pounds	Lard. pounds.	Pork. barrels.	Hogs. No.	Value of Hogs, Pork, &c.
1790	2,102,137	....	253,555	6,355	24,462	5,304	$ 242.308
1791	1.713.241	351,695	295 647	522,715	26,635	16,803	381 910
1792	1 964,973	263.405	585.353	515,245	38,098	21,291	Kentucky
1793	1,233,768	189,715	521,483	597 297	38 563	9,934	a State.
1794	1,472.700	241,570	995,593	1,028,410	47,242	5,413	....
1795	1,935,345	512.445	1,778.564	1,490 554	88.193	4,922	Tennessee
1796	1,173,552	540 286	2,096,177	1,124,971	73,881	6.753	admitted.
1797	804,922	254,799	1,081,008	731 511	40,125	3,484	French in-
1798	1,218.231	211,694	1,105 584	876,773	33,115	4,237	sults.
1799	1,200,492	231,226	1,412,005	1,451,657	52,268	3,786	French
1800	1,694,327	338,108	1,173,244	1,633,562	55,467	14,294	treaty.
1801	1,768,162	919,355	2.034,630	2 376,500	70,779	7;312	Ohio a
1802	1,633,283	266,816	1,588,267	1,958,400	78 239	5.501	State.
1803	2,097,608	133,606	1,686,546	2,052,302	96,602	6,859	1,800,000
1804	1,944 873	111,327	1,904.284	2,515,719	111.532	5 599	1,990,000
1805	861,501	116,131	903,924	1,308,287	57,925	2,808	1,190,000
1806	1,064,263	108,342	1,347,018	1,542.500	36.277	1,747	1,096,000
1807	612,421	136,460	1,311,246	1,815,998	39 274	1,831	1,157,000
1808	249,532	30,818	258,418	585,173	15,478	1.956	398 000
1809	522,074	57,260	1,082,610	1,371,089	46,652	537	1,001,000
1810	325,924	86,744	1,218,855	1,365,333	37,209	4,613	907,000
1811	2.790,850	147,426	1,286,809	1,927,451	37,270	4.454	1,002,000
1812	2,039,999	90,810	729,398	1,616,417	22,746	2,380	604,000
1813	1,486,970	58,521	607,196	1,084.565	17,337	485	457,000
1814	61.284	26,438	138.556	513 928	4,040	160	176,000
1815	830,516	72 364	695,357	1,045.633	9,073	757	498,000
1816	1,077,614	89,119	530,129	1,088,318	19 280	1,988	719,000
1817	387,454	106,763	341,419	926,018	14,462	1,103	537,000
1818	1,079,190	120,021	....	....	....	....	754 000
1819	1,086,762	135,271	....	....	....	....	1,009 000
1820	533,741	146,318	....	....	....	....	1.179,000

The first number in the lard column is in firkins, the rest pounds. Mr. Seybert's figures in the column for corn, for the years 1794, 1803, 1807, 1809, and in the cornmeal column for 1813 and 1815, differ somewhat from those derived from other sources; also, very slightly in a few other cases. When they differ, his is preferred, except in the quotations for corn-meal, in the year 1791–5 inclusive, which he gives in barrels,

as follows: 70,339; 52,681; 37,943; 48,834, and 102,529. These multiplied by 5 (the old Southern number of bushels for a barrel) will produce the first three figures in the cornmeal column exactly, the next two nearly. The rest of his figures for cornmeal, which extend to 1817, are given in bushels. The quantities of hams and bacon, lard, pork and hogs are his. A retrospect of U. S. imports and exports from 1790 to 1838, containing many interesting particulars, but not the above, (except the values of hogs, pork, &c. in the last column) will be found in the documents annexed to a Report of the Secretary of the Treasury on the state of the finances, dated December 3d, 1839. It is there stated, that "not till 1803 were exports regularly distinguished in the returns, as to the quantity and value of the different articles." The total exports from the United States in 1790 were over $20,000,000, and gradually increased from 1791, to $78,665,522 in 1799; after which they fluctuated, but rose to $108,343,150 in 1807, the year of the Embargo, which shut out the nations injuring our commerce, from the advantages of our trade. In 1808 the total exports were less than $22,500,000. In 1814, the third year of our war with the British, the whole exports were less than $7,000.000. "The largest exports from most of the Northern States, formerly consisted of foreign goods, lumber, fish, &c."

The total imports in 1790 were $23,000,000, and rose to $138,500,000 in 1807; the next year falling off to less than $57,000,000, and in 1814 to less than $13,000,000; but after peace, in 1815, they rose to $113,041,274, and in 1816 to $147,103,000—nearly double our exports of that year.

These changes are observable on a miniature scale in the above table. The first material falling off in the maize export was in 1796–7, during the French unpleasantness. It recovered, and went on swimmingly till 1805—6. The counter decrees of Napoleon and Great Britain, to break

down the trade of neutrals with the adverse power, reduced the corn export more than one-half, and still more in 1807, and subsequent years till 1811, when it was greatly swelled; but it became a very small item in 1814. The scarcity in the fall of 1816 reduced it, after its partial recovery when the war was over, to a low figure in 1817. Measures had been taken to protect the manufacture of cotton goods in Rhode Island and elsewhere, which had greatly flourished during the war, from the heavy English importations after its close. A home market was provided for corn and swine products, which partly accounts for the falling off of maize exports subsequent to 1819, which, in spite of greatly increased production, did not again reach one million bushels till 1846. The corn meal export was seldom large, but more uniform, the places of destination being nearer home. The export of pork went on increasing, and that of lard more rapidly and uniformly, as will be seen from the subsequent table.

A few facts in regard to the tonnage of the United States may be of interest here. Its total in 1789 was 201,562, which includes registered and enrolled sail tonnage. Of this amount, over 9,000 were in the cod fisheries; more than 68,000 in the coastwise, and nearly 124,000 in the foreign trade. The latter increased to nearly a million in 1810; the others less rapidly. In the four years ending with 1814, the foreign tonnage had lost nearly a third, and the coastwise gained more than a seventh; the fisheries losing more than half. The foreign gained more than one-fourth in 1815; the coastwise a small fraction; the fisheries tonnage more than doubled. By 1819 the foreign tonnage had lost nearly a third, the coastwise gained one-fifth, and the fisheries (cod and whale) were nearly trebled. The coastwise was now only about 10,000 tons behind the foreign tonnage, and each of them amounted to nearly 600,000.

The domestic exports of 1819, in all, were nearly $23 000,-000 less than those of 1818, and the imports for same, not exported again, were about $34,364 000 less than those of previous year. The values of these exports are stated to have been estimated "agreeably to the prices current, returned by collectors of the customs in their quarterly abstracts of exports for each year." But regular reports of the value and quantity of each article *imported* did not commence till 1821. The balance of trade had been very heavily against the United States in 1815 and 1816, but our industries, encouraged as they now were, gained rapidly, and this balance against us was fast diminishing. Very considerable exportations of foreign goods had been made. In 1820 we retained, for consumption, of our imports only $56,441,971, and our entire domestic exports for that year were $51,683,640. In 1821 the balance was in our favor.

This was during Monroe's administration, which was eminently a peaceful and prosperous one. By the discoveries and explorations of Grey, Lewis and Clark, our claim to the Pacific ocean was made clear. In 1817 the Wyandots and six other tribes of Indians ceded all lands to which they had title in the State of Ohio. Mississippi was admitted as a State. Canals connecting Lakes Erie and Champlain with the Hudson river were in progress, and were finished in 1823. In 1818 the Chickasaws ceded all their lands west of the Tennessee river, in Kentucky and Tennessee. Alabama was admitted in 1819, and Spain in the same year, by treaty, ceded both of the Floridas to the United States. The Missouri question came up in 1820, as to the extension of slavery, and that State was admitted in 1821, with a prohibition of that institution in the territories north of 36° 30′.

It is observable that the export of maize, which had been so small during the war with Britain, and recovered somewhat after its close, dwindled one-half in 1820. The value

XXXIV.

EXPORTS OF THE GROWTH AND PRODUCE OF THE UNITED STATES TO FOREIGN PORTS, FOR THE FOLLOWING YEARS, UP TO AND INCLUDING 1842, ENDING SEPTEMBER 30TH; FOR THE NINE MONTHS ENDING JUNE 30TH, 1843, AND FOR THE SUBSEQUENT YEARS, ENDING JUNE 30TH, (FROM U. S. P. O. REPORT FOR 1853).

Years.	Indian Corn. bushels	Value.	Cornmeal. Barrels.	Value.	No. of Hogs.	Pork. barrels.	Bacon and Hams. pounds.	Lard. pounds.	Value of Hogs, Pork, &c.	Total Value Corn & Swine Products.
1821	607 277	$261,099	131,669	$345,180	7 885	66,647	1 607 506	3.996,561	$1,354,116	$1.960.395
1822	509,098	378,427	148,228	522,229	9,798	68,352	1,142 945	4,137.814	1.357,899	2,258,555
1823	719.034	453.622	141,501	476.867	11,436	55,529	1,637.157	6.067,071	1,291,322	2,221,811
1824	779 297	351 665	152 723	384,675	8,838	67,229	1,409,199	5,053,182	1.489,051	2,225 391
1825	869 614	429.906	187.285	448,167	4 525	85.709	1,896,359	5,483.048	1,832,679	2,710,752
1826	505,381	381,955	158 652	622.366	6,939	88,994	1.836,433	7,231 643	1.892,429	2,899,750
1827	978 664	588 462	131 041	434.002	18.441	73,813	1.864,956	6.927,084	1,555,698	2 578,162
1828	704 902	342 824	174.639	480,034	16.171	53,836	1,837.920	7.493,319	1,495,830	2,318,688
1829	897,656	478.862	173.775	495.673	10,779	59 539	2.305,405	7.154,742	1.493,629	2,468,164
1830	444.107	224 823	115,301	372,296	22,294	45.645	2,154 986	6,001,417	1.315,245	1.912.364
1831	571,312	396,617	207.604	595.434	14,690	51,263	1,477,446	6,963,516	1 501,644	2.493.695
1832	451 230	278.740	146.710	480.035	5.266	88.625	1,810,830	7,756.782	1.928.196	2,686 971
1833	487.174	337,505	146,678	531.309	6.819	105,870	1.786,637	7,655 198	2.151.558	3,023,372
1834	303 449	203.573	149,609	491 910	3.338	82 691	1,520.638	9 050,342	1,796,001	2,491 484
1835	755.781	588 276	166.782	629 389	3,930	61,827	1,492,027	10,637,490	1,776,732	2,994.397
1836	124.791	103.702	140,917	621,560	1,231	22,550	1 398,475	6.493,878	1,383,344	2,108,606
1837	151,276	147 982	159 435	763,652	1,110	24,583	965.935	6,388,174	1,299,796	2.211 430
1838	172 321	141 992	171,843	722,399	366	31,356	1,194,890	7.209,478	1.312,346	2.176.737
1839	162 306	141.095	165.672	658,421	772	41,301	1,445.527	7,723,834	1,777.230	2.576,746
1840	574,279	338,333	206.063	705,183	4,854	66,281	1,643 397	7,418.847	1,894 894	2 938,410
1841	535 727	312,954	232 284	682,457	7,901	133,290	2,794,517	10,597.654	2,621,537	3,616,948
1842	600,308	345,150	209,199	617,817	5,564	180,032	2,518,841	20,102.397	2,629.403	3 592.370
1843	672,608	281.749	174.354	454,166	7,162	80.310	2,422.067	24 534.217	2.120,020	2.855 935
1844	825,282	404 008	217,882	641,029	9,615	161,629	3,886,976	25.746.355	3.236,479	4 281.516
1845	840 184	411.741	269.030	641,552	6,384	161,609	2,719.360	20.060.993	2,991,284	4 044.577
1846	1,826 068	1,186.663	298,790	915,081	7,437	190,422	3,006.630	21,843 164	3 883 884	6 015,628
1847	16.326 050	14.395 212	918.060	4,301,334	3,274	206,190	17 921,471	37,611,161	6,630.842	25.327 388
1848	5,817,634	3.837,483	582 339	1,807,601	4,750	248,269	33,551,034	49,625.539	9.003,272	14,648,356
1849	13,257,309	7.966.369	405.169	1.169,625	1.121	253,486	56,060,822	37,446.761	9,245.885	18.381,879
1850	6,595,092	3,892,193	259,442	760,611	881	188,841	41 014.528	54,925.546	7,550.287	12,203,091
1851	3.426.811	1,762 549	203,622	622 866	1.030	165,206	18.027,302	19.683,082	4.368,015	6.753.430
1852	2.627,075	1,540,225	181,105	574,380	185	83,382	5.746,816	21 281 951	3 765,470	5.880.075
1853	2.274,909	1,374.077	212,118	709,974	22	129,881	18,390,027	24 435,014	6 202,324	8.286,375

of the export of swine products, however, increased steadily from 1817 to 1822. About this time some sister republics were coming into existence. In 1823 our government acknowledged the independence of Mexico, Buenos Ayres, Colombia and Chili.

In a general statement of U. S. tonnage, extending from 1789 to 1871, found in Reports on Commerce and Navigation for 1871–2, the figures for steam tonnage begin in 1823 with 24,879 tons, enrolled and licensed. This amount, in 1830, had increased to 63,053, when the registered steam tonnage began with 1419. In 1831 the coastwise tonnage exceeded the foreign slightly. There had been a great falling off in both from 1828 to 1829, though the fisheries tonnage had increased nearly one seventh. Whether this resulted from the new tariff on wool, woolens, iron and cottons, &c. which caused so much opposition at the South, or from European wars, in which Russia and Turkey, and the new Republic of Greece were prominent parties, does not appear. The total imports fell off nearly one-sixth; foreign exports, one-fourth. The exports of corn, pork and lard were diminished from one-half to one-seventh, in 1830, from those of 1829, but those of cotton were increased. After South Carolina's nullification ordinance in 1832, and Mr. Clay's compromise in 1833, there was a heavy increase in the cotton export. The corn and pork export became very small in 1836, the year before the financial crisis.

There was an extraordinary movement in Indian corn in 1846–7, during the famine in Ireland, when the United States Government sent a ship load of provisions, gratuitously, to the sufferers, and private individuals added largely to the public bounty. There was a radical movement in Germany in 1848, which was felt in other portions of Europe. The export of cornmeal has been far less fluctuating than that of Indian corn, because the market has been nearer home

and less likely to be disturbed by outside influences. Gold was discovered in California in 1848, and very soon the rush to its diggings provided an abundant home market, now that this region had become the property of the United States. The rapid settlement of new States and Territories also produced a demand for this grain. The Indians became troublesome in the West, and so reduced the crops of maize. The agitation of the slavery question would naturally diminish the grain trade between the North and South; but would stimulate the production of cotton; and its exports in 1851, when those of corn dwindled one-half, rose to $112,000,000, but fell next year to $87,000,000; yet its wave gradually went up till it reached $191,000,000 in 1860, and then suddenly fell to $34,000,000.

The total tonnage of the United States reached its highest figures in 1861, being 5,539,813, of which 2,496,894 was foreign, and 2,704,724 was coastwise; 145,734 tons being in the whale fishery, 137,666 in the cod, and 54,795 in the mackerel fisheries. The next year the total fell off more than 400,000 tons; 117,756 being sold to foreigners. The coastwise in 1863 had grown to 2,960,633, and the foreign declined to 1.926,886; foreigners having purchased 222,199. In 1864 the foreign tonnage was still further reduced by the sale of 300,865, and in 1865 of 133,832 tons; and by smaller sales in subsequent years. In 1873 the coastwise tonnage was 3,163.220, the foreign 1.378,533; the cod fishery 109,-519, and the whale fishery 44,755.

The reciprocity treaty with Canada opened up a new market for maize, the exports of which, in 1854. were nearly triple those of 1853, and were greatly enlarged in '56, when the Kansas slavery question produced a rush of emigration thither, and a temporary civil war, but they fell rapidly in 1857, and did not recover till the first year of the great civil war. After a heavy export in 1862, it was reduced by the

ravages of the Alabama and other cruisers to less than 3,000,000 bushels in 1865. Its lowest since that was in 1870. Of late years its growth has been very rapid, especially to Great Britain, where its usefulness as feed for horses has been greatly extended.

In 1854 the number of hogs exported was 279; barrels of pork 220,147; hams and bacon, 45,953,473 pounds; pounds of lard, 44,450,154. The whole estimated value of these four products being $11,061,016. In 1855 the hogs exported were 431; hams and bacon, 38,188,989 pounds; lard, 39,025.492 pounds; total value $11,607,165. In 1858 the value of hogs exported was $810,406; of pickled pork, $2,852,942; of hams and bacon, $1,957,423; and of lard, $3,809,501.

In 1859 the value of hogs exported, $550,875; of pickled pork, $3,355,746; of hams and bacon, $1,263,042, and of lard, $3,268,406.

XXXV.

The following is made out from figures taken from U. S. P. O. Reports, showing the exports of Indian corn and cornmeal, with their respective values, for the following years:

Years.	Corn.		Cornmeal.		Total Value
	Bushels.	Value.	Barrels.	Value.	
1854	7,768.816	$6,074,277	257,403	$1,002,976	$7,077,253
1855	7.807,585	6,961,571	267,208	1,237,122	8,198.693
18 6	10,292.280	7,622,565	293,607	1,175 688	8,798,253
1857	7,505,318	5,184,666	267,504	957 791	6.142 457
1858	4,766,145	3,259,039	237,637	877,692	4 136,731
1859	1,719,998	1.323,103	258,885	994,269	2.317 372
1860	3 314,155	2,399,808	233.709	912.075	3,311 883
1861	10,678,244	6,890,865	203,313	692.003	7,582 868

Before 1850, pork packing, as an art, had reached a high degree of improvement. Cincinnati, being the centre of a great corn and swine producing region, attained and held the pre-eminence in this line, for a considerable length of time. Louisville, its near neighbor, also had large packing establishments. Gradually the business sprang up, on a smaller

scale, in many small places scattered throughout the West; and Chicago, after distinguishing herself in a remarkable degree as a transporter of grain, took hold of the packing business with great vigor, and eventually made, in some cases, the greatest showing in the number of swine killed.

We do not hear so much in this line, from St. Louis, whose receipts and exports are more varied, though very extensive; or from Pittsburg, a great coal and iron mart, or from the rapidly growing cities on the Lakes. Our leading exports of produce have been fast obtaining character throughout the world. Some such manufactures of corn as Maizena, have been shipped to the farthest islands. In 1864 the value of this export was $51,118, and in 1865, $162,801; and in '73, $424.552, of which England took $146,399; British Colombia, $8,427; Australasia, $41,254; British Africa, $9,370, and Japan, $2,643.

XXXVI.

Exports of Produce of United States to foreign countries, selected from the Reports of Commerce and Navigation, and Monthly Report for May and June, of Agricultural Department for 1876.

Yrs.	Corn.		Cornmeal.		Hogs.		Total Value of Corn and Meal.	Tot'l Value Corn & Hog Product
	Bushels.	Value	Barrels	Value.	No.	Value.		
1862	18,904,909	$10.387,383	253,570	$ 778,344	3.306	$ 23 562		
1863	16,119.476	10.592,704	257.948	1,013 272	9,467	96,373		
1864	4.096 694	3 353,280	262,357	1,349.765	9.199	86 907		
1865	2.812,726	3,679.133	199,419	1.489 886	1 400	12.771		
1866	13 516,651	11 070,395	237,275	1,129,484	951	15 454		
1867	14.889,823	14,871 092	284,281	1,555,585	3 577	40,092		
1868	11,147.490	13 094 036	336.508	2 068.430	1 399	18,447		
1869	7.047.197	6,820 719	309,867	1,656,213	....	......		
1870	1.392,115	1.287.575	187.093	935,676	12 058	189 753		
1871	9.826,309	7.458.997	211,811	951,830	8 770	61.390		
1872	34.491,650	23 984,365	308 840	1,214,999	56,110	548,153		
1873	38.541.930	23.794.694	403.111	1.474,827	99,720	787,402		
1874	34,434.606	24,769.951	*1,551,228	1,529 399	....	....	$50 mill'ns	$100 mill's
1875	28,858.420	24,456 937	*1,166,616	1,290.533	....	....	to ½ inch.	to ½ inch.

* Bushels.

XXXVII.

EXPORTS OF SWINE PRODUCTS OF U. S., SELECTED FROM REPORTS ON COMMERCE AND NAVIGATION.

Yrs.	Pork.		Hams and Bacon.		Lard.		Lard Oil.
		Value.	Pounds.	Value.	Pounds.	Value.	Value.
1862	* 308,051	$ 3,980.155	141,212,786	$ 10 290,572	118,573,307	$ 10 004,521	$ 148,056
1863	‡ 326,119	4,334,775	218,243,609	18,658,280	155.336,[illegible]96	15,755 570	983,349
1864	* 317,597	5,828,030	110,886,446	12,223,327	97 190,765	11,260.728	377,994
1865	* 208,132	6,843,135	45,990.712	10,521,702	44,342,295	9,107.435	155,454
1866	†30,056,788	4,788,484	37,588,930	6.269,796	30,110,451	5,970,651	70,360
1867	....	3,597,690	....	3 291,176	....	6,634.556	176,363
1868	†28,690,133	3,267,652	43,659,064	5,476,998	64,555,462	9.427,831	330 179
1869	†24,439,832	3.422,928	49,228,165	7,482.060	41,887,545	7,443,948	....
1870	†24,639,831	3,253,137	38,968,256	6,123,113	35,808.530	5,933.397	124,860
1871	†39.250,750	4,302,320	71,446,854	8,126,683	80,037,297	10 563 020	153 850
1872	†57,169.518	4,122,308	246,208,143	21,126,592	199,651.660	20,177,619	432.483
1873	†64,147,461	5,007,035	395,381,737	35,022,137	230,534,207	21,245,815	298,731

* Barrels. ‡ Barrels and tierces—add 1,155. † Pounds.

The distribution of the exports, considered for the longest term of years, will show us who are the nation's best customers. From the very beginning of its commercial records, with a few exceptions, Great Britain and her dependencies (*a*) have taken the largest amounts, in value, of its exports. In 1790 they took $9,246,562, in all. France and dependencies, (*b*) about half that sum; Spain and dependencies, (*c*) nearly two-ninths of same; Netherlands and dependencies, (*d*) a little less than Spain; Portugal and dependencies, (*e*) nearly one-seventh of Britain's. The Hanse Towns, (*f*) not quite half a million; Denmark and dependencies, (*g*) one quarter of a million; Sweden and dependencies, (*h*) the lowest, $47,240. In 1800 *a* took (in millions) about twenty-seven and one-third; *b*, five and one-sixth; *c*, fifteen and two-thirds; *d*, five and two-thirds; *e*, one and one-fourth; *f*, eight; *g*, two and one-eighth; and *h*, three-fifths. In 1810 *a* took sixteen and one-half; *b*, one-seventh; *c*, nearly fifteen; *d*, one-sixth; *e*, seven and two-thirds; *f*, one and one-eighth; *g*, ten and one-half; and *h*, seven and nine-tenths. In 1820 *a* took nearly twenty-nine; *b*, nine and one-ninth; *c*, six and six-sevenths; *d*, seven and two-thirds; *e*, one

and one-third; *f*, two and three-fifths; *g*, nearly two and one-half; and *h*, nearly two-thirds. By this time Russia, that in 1810 had taken $3,975,698, now took over one-third of that sum, and China, $1,479,701. In 1821 Brazil was numbered among our customers to the amount of $1,381.760. After 1825 the South American States generally, were reckoned in. By this time the annual Reports on Commerce and Navigation of the United States made exhibits in detail of the distribution of the principal articles exported, with their values. In the year ending September 30th, 1827, (see table of exports) England took, of the Indian corn export, 562,603 bushels—more than half; the French West Indies the next largest quantity, 79,288 bushels; the British American Colonies the next, and Madeira Islands the next, 65,311 bushels. The West Indies took, in all, 248,746 bushels; Scotland none, and Ireland in that year only 8,200 bushels. Of the small cornmeal export, the West Indies together took about 107,000 barrels—four fifths. Of this, the Danish West Indies took 65.160 barrels, and Swedish, 14,057. The British American Colonies took 18,640 barrels; England only 405. Of hog products exported the same year, Cuba (one of the Spanish dependencies) the largest by far, $736,-619; Hayti the next, $199,818; and the Danish West Indies, $105,937. The West Indies together, $1,172,953—about three-fourths. Cuba and Hayti took the most pork—about one-half; Cuba, Danish West Indies, Hayti and Brazil, three-fourths of the hams and bacon; Cuba, nearly three-fourths of the lard; and the British American Colonies, two-thirds of the live hogs. England took only $22,834—all in pork and bacon. Sixteen years afterwards, the ending of the fiscal year for the U. S exports was changed to June 30th, making the account for 1843 run only nine months. The export of corn in that time was less than three fourths of the year's export for 1827, and the proportion of cornmeal export

greater. Of corn, Mexico took the largest part, 357,894 bushels; the British West Indies and American Colonies, respectively, 198,851 and 60,791 bushels. England, Scotland and Ireland, none. Of cornmeal, the two last named Colonies took the greatest part, 88,078 and 19,897 barrels; and the Danish West Indies, a steady customer in this line, 51,924 barrels. Of pork, the British West Indies took 10,408. and British American Colonies, 37,828 barrels—more than half; Hayti, more than one ninth; and Cuba, one-third of that. Of hams and bacon, in pounds, Cuba took nearly a third; British West Indies, a twelfth; England, over a fourth; Brazil, one-twentieth; and Mexico over one-thirtieth. Of the lard, France, a nation of cooks, with her little West Indies, Guiana and Fishery Islands, bought 11,799,076 pounds; Cuba, 4,400,122; England, 4,539,216; British West Indies, 724,728; China, 502,170; and Danish West Indies, 270,677. Nearly all the hogs exported were sent to British ports in the West Indies, American Colonies and Guiana.

Eighteen years later, U. S. documents for 1861 make the exports of Indian corn and cornmeal to British realms more than $7,150,000; and pork, bacon, lard and lard oil more than $8,879,000—the corn export being two-thirds of the whole exported that year. England, Scotland and Ireland took about four-fifths of it; the British North American Provinces, about one-seventh; and British West Indies and Guiana one-fourteenth. The previous year's corn export for England, Scotland and Ireland had been little more than one-fourth, and its swine export less than four-sevenths in value. The British West Indies were the best patrons in the cornmeal trade; after them, the British North American possessions on the Atlantic, and next, the Danish West Indies. Cuba and Porto Rico in 1861 took nearly $1,120,000 of swine products; and Hayti more than $528,000—mostly

pork. In 1862 the British Islands added about 50 per cent. to their imports of our maize and meal, and about doubled their import of our swine products. Canada also improved on '61. Cuba took one-half more lard, and Hayti more than 40 per cent more pork. France took, of hog products, mostly lard, more than $2,000,000; and Belgium nearly $450,000, lard and bacon. In 1863 our exports of Indian corn to England were $3,846,404, and to Ireland, $3,882,-801; and of swine products, to Great Britain, $22,590,829, of which England took more than $21,000,000, two-thirds of which was bacon. The exports to Canada, and her British neighbors, of maize and meal were $2,066,136, and of swine products, $1,529,814; and to Cuba and Porto Rico, of the latter, over $2,525,000; to France, of swine products, over $5,168,500; to Belgium, over $1,270,000; and to other European powers, such as Hamburg, Bremen, Holland, &c. of the same, in amounts varying from $1,000,000 to $400,000 —lard was the heaviest item. To Mexico, the exports of maize and meal were $272,411; to the South American States, nearly $200,000. For lard, Venezuela, Brazil, Chili, Peru, and the Guianas were our customers, in amounts varying from $43,000 to nearly $300,000; and for pork, bacon and lard oil in smaller amounts, respectively. More or less of these products was shipped to the East Indies, China, Japan, Australia, Polynesia, and such scattered islands as the Madeiras and Azores.

The export prices (see U. S. Agricultural Report, 1868) as an average, have been stated for a period of ten years ending 1840, at 71¼ cents per bushel of Indian corn, and $3.73 per barrel of cornmeal; for ten years ending 1850, at 69¾ cents per bushel for corn, and $3.31 per barrel for cornmeal; for ten years ending 1860, at 72¾ cents, and $3.76 of same, respectively.

Since 1860 the average has been:

YEARS.	PER BUSH.	PER BBL.	YEARS.	PER BUSH.	PER BBL.
1861	$0.64½	$3.40	1865	$1.30	$7.47
1862	55	3.07	1866	82	4.76
1863	65¾	3.93	1867	99¾	5.47
1864	81¾	5.14	1868	1.17½	6.15

Perhaps the most interesting year connected with these reports, was that of 1864. The three great British Islands received, as our exports, of Indian corn, $1,647,265; of corn-meal, $5,095; of Pork, $798,037; of lard, $3,094,630; of lard oil, $217,962; of bacon, $10,495,231. To Canada, and other British possessions in North America, we exported in that year more than $1,000,000 of maize, and $233,603 corn-meal; nearly $2,500,000 of pork; $337,617 of bacon, and $269,189 of lard. To the British West Indies, and possessions in Central and South America, (including British Honduras and Guiana) in round numbers, $254,000 maize, $659,000 meal, $803,000 pork, $306,000 lard, $34,000 lard oil, and $178,700 bacon. To Cuba and Porto Rico, nearly $223,000 of corn and meal, over one-eighth of this being grain; nearly $2,207,000 of lard; $453,333 of hams and bacon, and nearly $415,000 of pork. France received nearly $2,770,000 lard; Belgium, $311,063, and Bremen, Hamburg and the German Zollverein, over $609,000 of same. To Mexico, nearly $400,000 of swine products, and over $257,000 corn and meal; to South America, more than $1,000,000 of pork, lard, &c. North Americans, in corn and swine products, were our customers for over $4,000,000.

But sufficient space has already been given to the distribution of the exports, in this connection. Its illustration for the subsequent years may be given more briefly in the forms of tables, or diagrams. A few facts in regard to the imports for which our products are exchanged, may not be out of place. In 1827 we imported from Cuba, cigars, sugar,

molasses and spices. Sugar, also, from other Spanish, and the Danish West Indies; molasses from French, British and Dutch West Indies. Iron from Great Britain, Sweden and Norway, and Russia. Hemp from Russia; cotton bagging from Scotland; Silks from China, France, England and Italy. Wines from Netherlands, France, Portugal, Spain, Gibraltar, Madeira and Teneriffe. Opium from Turkey, the Levant and Egypt. Spirits from Netherlands and Danish West Indies. Indigo from Colombia and Mexico. The former also sent us Cocoa and spices, and the latter, bullion; Brazil, hides; Spain, raisins; China, teas; and England, in addition to hers above stated, coal, salt, white lead, cotton bagging, carpeting, watches, harness, hosiery, cotton goods, woolens and copper. Peru, Colombia, Mexico and British West Indies sent us spices. Under amounts of $100,000 very many other articles were imported.

In 1843 the records exhibit imports from England of greater variety than from other countries: castings, iron, cloths and cassimeres, cottons, manufactures of flax, laces, sheet tin and books. France shipped blankets, worsteds, cottons, leghorn hats and silks. Cuba added coffee to her sweets, which was also imported from Hayti, Venezuela and Brazil. Russia sent us sail duck; China, tea and silks. Australia, Brazil and the Argentine Republic, wool; and the last two, as well as other South American States, material for leather; Manilla and Philippine Islands, sugar; Mexico, dye-woods; and Texas, not then admitted, raw cotton. Spain, who has a mountain of salt, and Portugal, helped our supplies of that prime necessity. A great variety of fruits and spices, in smaller quantities, came from Southern Europe and the East Indies.

Some of the imports in 1862 were madder from Holland and her Colonial possessions; gums arabic and tragacanth, as well as benzoin and myrrh from British Islands;

dyewoods in sticks from Central and South America. Gold in bullion, from Canada and the British North American possessions, New Grenada, Venezuela, and from Liberia and other ports of Africa.

The imports in 1873 were more varied: raw jute and other grasses from British East Indies, Mexico and Germany—gunny cloth from the Indies; marble from England, Scotland, Italy and Nova Scotia; old iron from Belgium, France, Scotland, Ireland, Netherlands, Spain, Cuba, Quebec and Ontario. Steel rails for railroads from England and Scotland. Silver bullion from Mexico chiefly; gums from Austria and the British possessions in Australia; horse hair for weaving, from the Argentine Republic and Brazil. India rubber and gutta percha from Brazil, Central American States, British West Indies, Colombia and Mexico. Volatile oils and paintings from Italy. Cotton and linen rags from Belgium, Italy, and Turkey in Africa; raw silk from China; nitrate of soda from Chili and Peru; bars of tin from British and Dutch East Indies. Cork, bark and wood, unmanufactured, from Spain and Portugal; crude camphor from Japan; Cocoa from Colombia and Guiana. Fruits and nuts from Honduras, Greece, Italy and Spain, and Turkey in Asia. Goat's hair, wool of alpaca and sheep, from Argentine Republic, Chili and Brazil. This list is but a small portion of the products enumerated as imports, in the late U. S. Reports on Commerce and Navigation.

In 1791 (including the cornmeal with the grain, at about four bushels to the barrel) the quantity exported, to each 100 inhabitants, was about $52\frac{1}{2}$ bushels; in 1800, about $38\frac{1}{4}$; in 1810, about $9\frac{1}{3}$; in 1820, nearly $11\frac{2}{3}$; in 1830, nearly 8; in 1840, about $8\frac{1}{5}$; in 1850, $32\frac{9}{10}$; in 1860, $13\frac{1}{2}$; in 1870, $5\frac{1}{2}$. The last census year showed the lowest Indian corn export for many years, and the years subsequent to 1871, the very highest. A fair estimate of the population for 1876 would

make the proportion of the export much more than 5½; but it is not considered even safe for the agricultural interests of the United States, to increase the exports of this grain rapidly. Indian corn, being a gross feeder, exhausts the soil if raised successively on the same land for a long period, without abundant returns, in some way, of its treasures removed.

Before giving some account of the exporting districts of United States, we extract the following summary of exports of corn and meal from the Monthly Report of the Agricultural Department, for May and June, 1876.

Year.	Corn.		Cornmeal.		Total.
Five years ending	Bushels.	Bushels.	Bushels.	Bushels.	
1830	3,530,710	...	3,133,632	...	6,664,342
1835	2,568,946	...	3,269,532		
		6,099,656		6,403,164	12,502,820
	6,099 656		6,403,164		
1840	1,184,973	...	3,375.720		
		7,284,629		9,778,884	17,063,513
	7,284,629		9,778,884		
1845	3,474,109	...	4,530,996		
		10,758,738		14,309,880	25,068,618
	10,758,738		14,309,880		
1850	43,822,153	...	9,974,800		
		54,580,891		24,284,680	78,865,571
	54,580,891		24 284,680		
1855	23,905,196	...	4,485,824		
		78,486,087		28,770,504	107,256,591
	78,486,087		28,770,504		
1860	27,597,896	...	5,165,368		
		106,083,983		33,935,872	140,019,855
	106,083,983		33,935 872		
1865	52,612,028	...	4,706,428		
		158,696,011		38,642,300	197,338,311
	158,696,011		38,642 300		
1870	47,993,276	...	5,420,096		
For the year		206,689,287		44,062,396	250,751,683
	206,689,287		44 062 396		
1871	9,826,309	...	850,504		
		216,515,596		44,912,960	261,428 556
	216,515,596		44,912,960		
1872	34,491,650	...	1,235,360		
		251,007,246		46,148,320	297,155,566
	251 007,246		46,448,320		
1873	38,541,930	...	1,612,444		
		289,549,176		47,760,764	337,309 910
	289,549,176		47,760,764		
1874	34 434,606	...	1,551,228		
		323,983,782		49,311,992	373,295,774
	323,983,782		49,311,992		
1875	28,858,420	...	1,166,616		
		352,842,202		50,478,608	403,320,810
	352,842,202		50,478,608		

In the more recent Reports on Commerce and Navigation, the exports of the United States are stated not only with reference to the foreign countries to which they are exported, but also with respect to the districts marked out for the purpose of collecting the revenue. The names given them do not always indicate the chief places of export, within their boundaries. They have also changed more or less, or rather the enumeration of them in the Reports from year to year. For instance, there were twenty-eight in the list for 1864, or rather twenty-eight numbers including them, the first beginning with Passamaquoddy, Maine, from which was exported 5,630 bushels of corn, and only 60 barrels of cornmeal; but pork, lard and bacon to the value of more than $31,600. Portland, Maine, exports very little corn or meal; but lard to the amount of $123,452, and pork, about one-thirteenth that. The other ports of Maine export but a small quantity; so with the ports of New Hampshire. Two numbers are here allowed to Massachusetts. No. 5 containing Boston and Charlestown, and No. 6, the other ports of the State. Boston district exported in 1864, nearly $1,341,000 in all, pork being nearly half, lard one-third, and cornmeal nearly one-thirteenth. Boston's is about 4 per cent of the U. S. export. The prices of corn, being higher in that neighborhood, prevent it from exporting largely of this grain. The 7th number includes the ports of Rhode Island, that of Providence being chief. The exports from this district do not reach $100,000. The 8th No. includes the ports of Connecticut, (New London, New Haven and Fairfield) with rather more of an export. The 9th, New York, is by far the largest. The bushels of corn exported in 1864 were more than two and one-half millions. No. 10 is the Champlain (N. Y.) district. No. 11, the Lake ports, returning about three-tenths of a million dollars. 12th, Vermont; 13th, Newark, and ports of New Jersey. 14th, Philadelphia; 15th, Erie; 16th,

Delaware—cornmeal, &c., more than $68,000. 17th, Baltimore; 18th Beaufort, North Carolina, and 19th, Beaufort, South Carolina. 20th, Key West, in Florida; 21st, New Orleans—the city. 22d, Brazos Santiago, Texas; 23d Cuyahoga, and the Lake ports of Ohio. 24th, Detroit and Mackinaw, Michigan; 25th, Chicago, Illinois. 26th, Milwaukee, Wisconsin, which exports some $217,000 of swine products, mostly pork. 27th, San Francisco, California. 28th, Oregon and Washington Territories; swine and products, over $50,000. Reference is made only to corn and hog products.

The Report for 1867 gives numbers for 72 collection districts, including, in Maine, Frenchman's Bay, Machias, Castine, Wiscasset, Bath, Portland and Falmouth, Belfast and Bangor. Portland being the only one returning a considerable amount of exports. Portsmouth, N. H. is the 10th on this list, with only $84 of cornmeal. Vermont, the 11th, does better, being a border district not far from the great Canada thoroughfares. Massachusetts has Newburyport, Gloucester, Salem, Marblehead, Boston, Plymouth, Fall River, New Bedford, Edgartown and Nantucket, all of which, leaving out Boston, amount to little more than $50,000. 22d to 24th, Providence, Bristol and Newport, hardly reach $2,100. New London, New Haven and Fairfield do much better, especially with cornmeal. 28th to 35th are New York ports, of which Oswego and Buffalo are the chief, outside of the great City. Philadelphia's export of corn is, in a rough calculation, one tenth of that of NewYork; of meal not quite, one-fifth; of lard, one-fourteenth; of lard oil, one-fortieth; and of pork, one-twentieth. Baltimore exported, in 1867, less corn, more cornmeal, and very much more of hog products than Philadelphia. Delaware shipped nearly $32,000 cornmeal. Norfolk is an old exporting city, which sent off about seven times as much corn in 1791, as it did in the seventy-sixth year after. Of Nos, 45 to 58, includ-

ing Edenton, Newbern, Beaufort, Wilmington, Charleston, Georgetown, Savannah, Mobile, Pensacola, Key West, St. Johns, Appalachicola, Fernandina and Pearl River, only Charleston, Key West and Savannah exported anything. No. 59, New Orleans, exported nearly $500,000 corn and swine products. Texas (60th) exported less than $600 bacon and lard. Miami, 62d, (does this include Toledo, Ohio?) exported more than 259,000 bushels of corn. Sandusky, about $1,820 corn and bacon. 64th, Cuyahoga, (Cleveland) nearly $108,000 corn. Detroit, Port Huron and Michillimackinac are in Michigan, and except the latter, deal largely in exports. Chicago comes nearest New York in the maize export; Milwaukee is more of a wheat exporter. The remaining three numbers, for Oregon, Puget's Sound and San Francisco, are the last on this list, with a small trade in this line.

The lists for 1871 and '73 contain a few more numbers, but are arranged in alphabetical order.

The changes in the exports of the larger cities, included in the following tables, will be best indicated therein. Brunswick, Georgia; Corpus Christi, in Texas; Teche, in Louisiana; Minnesota, and Duluth in that State, and Superior, in Michigan, are new districts, and probably destined to be exporting places of considerable importance. The Portland (Maine) export of maize was much smaller, and of meats, much larger, in 1873 than in '67. Its bacon and lard export was greatly extended. But as a rule, the business in this line, in the smaller ports on the Northern Atlantic coast, seem to have fallen off in the interval. New Haven, New London and Delaware are among the exceptions. Key West, in Florida, improved greatly, exhibiting only $255 in '67 and over $200,000 of maize and hog products in '73. Texas improved somewhat; and those of San Francisco were about doubled. Oswegatchie, in New York, gained largely.

It is clear that the Northern ports bordering on Canada and Ontario, are destined to great improvement as exporters of these products. The establishment of a more permanent government, on a more liberal basis, as well as the natural advantages of these British provinces are inviting immigration, and the discovery of gold in British Colombia, will doubtless aid their agricultural and commercial progress. Important lines of communication have been established.

Taking into view the whole history of the West especially, Cincinnati, Chicago and Toledo, and perhaps Louisville and Indianapolis, may be considered Indian corn cities. It is true, the iron business has done a great deal for the first; but pork packing seems to have done more towards establishing its character, and preparing it for entering successfully on general manufacturing. The pork business draws in a large number of farmers, and dealers in farm produce. St. Louis, Chicago, Detroit, Toledo, Cleveland and Buffalo, have been to a considerable extent, and some of them to a great extent, transporting cities. It is probable that a city in a favorable position as a transporter of produce stands the best chance for rapid growth. Where large capital is invested in conveniences for the reception and storage of grain, and in safe and fast lines of movement both by water and land, better prices can be given for the great staples, and sales at a reasonable price can be made more certain. And persons or firms forwarding their produce to such places, generally find it convenient to make their wholesale purchases there, and especially to buy their machinery. It is the policy then, for transportiug cities especially, and for manufacturing cities generally, to connect themselves with as wide a circle of productive and commercial districts as possible. The success of the three great Western cities is largely due to this. New Orleans has so many natural advantages that it must, in due time, take its place again as a large exporting city.

The developments in the character of the new lands acquired by the United States, since the introduction of irrigation on a large scale, make it almost certain that the grain culture will keep pace with the increase of population. But the facts show that foreign exports of maize products will not; and, although the success of the United States in maize culture, accompanied with immense immigration, past and to come, familiarizes the old world nations with its advantages as food for man and beast, it is better that the culture, rather than the product, should be successfully carried round the world. It has been a common saying with experienced farmers, that a good crop of Indian corn makes everything on the farm flourish. Its large leaves and widely extended roots make it eminently calculated to prepare the way for other products. Its widely extended culture is also favorable to health.

In the East there seems to be a tendency more and more towards the largest cities, for the purpose of exportation, especially for exports to Europe. One reason of this may be the recent high development of steam navigation, enabling the largest merchant vessels to take in very heavy freights at cheaper rates; so that even maize has been sometimes sold at a less price, by the wholesale, in Liverpool than in New York. But the state of the currency came in for a share of this result.

Our notices of early exports, recorded from year to year, begin with Philadelphia, as follows: (See U. S. P. O. Reports)

YEARS.	CORN, BUSH.	MEAL, BBLS.	YEARS.	CORN, BUSH.	MEAL, BBLS.
1831	42,293	45,432	1839	17,117	73.800
1832	48,589	50,323	1840	76,749	89,486
1833	66,708	51,903	1841	80,266	108 822
1834	31,526	50,018	1842	83,772	97,884
1835	25,457	50,869	1843	74,613	106,484
1836	19,117	42,798	1844	110,068	101,356
1837	21,486	63,803	1845	129,256	115,101
1838	17,087	64,002			

There were shipped into Buffalo by the lakes in 1843, of maize, 223,963 bushels; in '44, 137,978 bushels; in '45, 54,200.

The following, made up from U. S. P. O. Reports, shows the corn exports of Philadelphia, compared with the receipts and exports of Boston; the bushels of corn that came on all the canals (*a*) to Hudson river; and exports (*b*) from Chicago.

Yrs.	Philadelphia.		Boston.				Canals. (*a*)	(*b*) Corn Export bush.
	Corn. bushels.	Meal. barrels.	Corn, bushels. Receipts.	Corn, bushels. Exports.	Cornmeal, bbls. Rec'pts.	Cornmeal, bbls. Exports		
1846	279,820	144.857	2,374.484	191,254	8,637	8,651	1,610.149	11,947
1847	1,102,210	300 531	2,601,424	568,025	25,080	44.903	6,053,845	67,315
1848	817,150	140,014	3,748.509	518,866	41,144	42.849	2.953.963	339,741
1849*	906,823	91.349	2,789 318	325,768	Cholera	in U. S.	5.121,270	644,848
1850	602.680	94,334	2,116,744	....	....	....	3,228,056	262.013
1851	554,545	65,385	2,175,367	....	....	....	7,670.345	3221,317

* See U. S. P. O. Report, 1849–50, (pages 532–533) for year ending Sept. 30th, '49.

For the month of January 1849, there were exported from New York City to Liverpool 109,600 bushels of corn, of United States growth; 6,063 bushels to Ireland; 400 to the British North American Colonies, and 669 to the British West Indies. In Baltimore the inspections of cornmeal for 1848 were 129 hogsheads, 45,451 barrels, and 1,044 half barrels; in 1849, 428 hogsheads, 51,772 barrels, and 2,051 half barrels. (See U. S. P. O. Report, 1849–50, page 535.)

In the three following years, from the opening to the close of navigation, there were received at Buffalo, by the lake:

Years.	Corn, bushels.	Pork, barrels.	Lard, pounds.	Bacon, pounds.
1847	2,862.300	63,750	3,436,000	....
1848	2,298,100	66,000	5,632.112	....
1849	3,321,651	59,954	5,311.037	5.193,996

Bacon in 1847 and '48 is included in the pork.

There were first cleared at Buffalo, (canal freight) in 1848, 2,187,562 bushels of corn, and 3,328,463 in 1849; barrels of pork, 67,076 in '48, and 41,643 in '49; bacon, 7,248,347 and 4,379,058 pounds; lard, in the same years, respectively, 6,056,470, and 4,344,725 pounds.

Toledo shipped to Oswego, during the season of 1849, 186,690 bushels of corn, 200 barrels of cornmeal, 26,227 barrels of pork; 3,212,320 pounds of bacon, and 3,991,373 pounds of lard and grease. The following are the principal places where hogs were packed in the West, in 1849–50, with the numbers cut. (See U. S. P. O. for those years.)

OHIO.	
Miami and Scioto Valleys,	122,000
Cincinnati,	393,775
Ripley, (estimated)	8,000
Total,	523,775
KENTUCKY.	
Louisville, Jeffersonville and New Albany,	184,000
Maysville,	14,000
Total,	198,000
INDIANA.	
Whitewater Canal,	62,000
Madison,	86,709
Indianapolis,	14,000
Evansville,	14,500
Terre Haute,	59,566
LaFayette,	39,200
Total, with other places,	428,575
ILLINOIS.	
Shawneetown,	12,000
Lacon,	11,500
Peoria,	21,000
Pekin,	26,000
Canton,	19,000
Springfield,	19,500
Beardstown,	31,000
Alton,	30,000
Chicago, winter packing,	11,500
Total, with other places,	268,100
MISSISSIPPI RIVER.	
St. Louis,	124.000
Hannibal,	24.500
Quincy,	29,000
Keokuk,	19,000
Burlington,.	29 000
Total, with other places,	252,900
Grand Total,	1,871,330
Baltimore, in 1848–49,	150,000
Baltimore, in 1849–50,	100,000

The tonnage of the principal ports of the U. S. for the year ending June 30th, was:

	TONS.	95ths.
New York,	796 491	79
Boston,	296 890	04
New Bedford,	123,911	57
Bath,	88 820	84
Portland,	84.568	80
Philadelphia,	188.057	21
Baltimore,	134,025	66
New Orleans,	240.206	24
Charleston, S. C.	29.285	48
Wilmington, N. C.	16,641	87
Norfolk,	23,016	26
Mobile,	25,067	79
Buffalo.	40,667	34
Pittsburg,	35,770	63
Detroit,	33 466	94
St. Louis,	32,255	08
Cuyahoga,	30,047	11
Oswego,	22,151	68
Chicago	17.832	43
Cincinnati,	16,897	74

There arrived at, and cleared from, Cleveland, Ohio, by way of canal, in the years—

	1848.	1849.		1848.	1849
Corn, bushels,	621,454	547,605	Bacon, pounds,	1,820,155	1,145,583
Pork, Barrels, .	26,111	23,031	Lard, pounds,	1,636,803	1,723,806

Of the exports of Indian corn to foreign countries, in 1873, reckoned in bushels: New York exported more than one-half; Baltimore, more than one-sixth; Chicago, nearly one-tenth; Philadelphia, nearly one-thirteenth; Miami district, nearly one-fourteenth. After these, come Boston and New Orleans, in nearly equal quantity. Of barrels of cornmeal, New York exported, in round numbers, 201,000; Boston, 72,000; Baltimore, 62,000; Philadelphia, nearly 33,000. Of the new exporting districts, Toledo, and Huron (Michigan), are remarkable for rapid increase.

With regard to the general policy of exporting other products than Indian corn, perhaps the result of Mr. Sullivant's investigations as to hog feeding and pork making, contained in the Ohio Agricultural Report, for 1869, furnish one of the best illustrations. One bushel of corn (56 pounds) fed on the ear, "returns, under ordinary circumstances, ten pounds of pork." Taking the ordinary rates of freight, from Chicago to Liverpool, on corn and pork, and making due allowances for the expense of slaughtering and packing, and the difference in the selling prices there, between a pound of Indian corn and a pound of mess pork, and it will be seen how much less is taken from the farmer's profits by the freight on corn, in pork, than on corn in grain. Then the manure saved in the process of feeding, and skillfully applied, is clear gain to the farm. The difference in the value of the corn and meal, and the swine product exports in 1873, the latter being about two and a half times as much as the former, shows how well these facts are appreciated. Even in 1821, when values were first apparent for corn and meal,

in the returns of export above referred to, the total value of swine products exported was more than double that of corn and meal.

But whether it is necessary to the progress of agriculture in the United States, to extend this rule of limitation of the exports of Indian corn to our near neighbors as fully as to far distant, and especially trans-atlantic countries, is another question. Cuba is about as far from New Orleans as St. Louis, and it is to be presumed that the sugar culture, and that of coffee, which afford our States immense supplies of articles which enter into the consumption of the great majority of households, would be nearly as wearing to the soil of that island, as maize culture is to that of the Ohio valley. But it so happens, so far, that Cuba does not need our corn as we do her sugar. But Mexico, Honduras and St. Thomas are not much more distant, and corn meal has always been in demand in the Danish West Indies, and may become so in the States south of us. Guiana and Venezuela are sometimes good customers in this line, and the waste of the articles we obtain from them may help to keep up the fertility of our corn lands. We could spare some maize, if needed, to obtain the guano of Peru. Canada, New Brunswick and Nova Scotia are just over the line, and they have greatly increased their facilities for transportation. In proportion to their population, they seem to have been as good customers in this line as the parent country. Their rivers run into the lakes that aid so much in sending moisture to our farms, and furnishing water-way for their products.

To exhibit the consumption of corn in the United States, as food, &c., for man and beast, in various forms, it is only necessary to deduct the export, for the given year, of Indian corn and cornmeal, in bushels, and the quantity used as seed, from the entire estimated product. The Monthly Agricultural Report, for May and June, 1876, gives, as the

quantity of seed for 1870, 12,882,325 bushels; for 1871, 11,363,712; for 1872, 11,842,278; for 1873, 13,065,716; and for 1874, 13,678,972. The bushels of corn and meal export are contained in the general summary of exports above quoted, from the same document. The whole consumption as thus calculated, would be 1,070,695,802 bushels for 1870; 944,807,278 for 1871; 1,040,722,348 for 1872; 883,222,450 for 1873, and 806,444,492 for 1874.

CHAPTER VI.

BOTANICAL CHARACTER AND VARIETIES OF INDIAN CORN.

Before this plant is botanically described, it may be of interest to give some of the names it has borne in the different regions over which it has traveled. It has already been stated that the original of the word maize is the Haytian *mais* or *mahiz*, as differently spelled by historians. Some, however, have supposed that it came from the Lettish or Livonic *mayse*, signifying bread. *Trigo de Indias* seems to be a Spanish term founded on the fact that Columbus brought samples of it to his home, in Spain, after his first voyage in search of India, which resulted in the discovery of America. The Europeans of that age had the Indies on the brain, and Columbus, in his first grand adventure, supposed he had found them. Another of these European names for this corn was *Ble d'Indie*. As it was not very long in finding a congenial soil in those magnificent farming districts which Turkey claims to rule, and is now struggling to retain, from which centre it gradually spread among the neighboring nations, it acquired the common name of *Ble de Turquoise*.

The botanical name is *Zea Mays*. *Zea* is from the Greek *zoo*, to live. The ancients of the East had their bread made

out of one or more of the grains native to their several districts, from the peninsula overlooked by the pillars of Hercules to the Indian Archipelago; and this they considered, as we do our bread, the staff of life. Hence *Zea* seems to include all bread-stuffs, although the modern systems of botany, being founded on more technical distinctions, have in some cases classed the bread-stuffs with the grasses.

A description contained in the American Farm Book is less cumbered with scientific terms than those generally given by botanists: "A strong, reedy, jointed stalk, provided with large alternate leaves, almost like flags, springing from every joint; the top producing a bunch of male flowers of various colors, called *tassel.* Each plant has one or more spikes, or *ears.*" "These ears proceed from the stalk at various distances from the ground, and are closely enveloped by several thin leaves—a sheath—the *husk.* The ears are cylindrical, with a pith, called *cob*; the seeds are ranged all over it, in eight or more straight rows, each row with as many as thirty or more seeds. The germs of the seeds are nearly radial from the center of the cylinder; from these eyes proceed individual filaments—the *silk.*" "These (filaments) hang in a thick bunch from the point of the husk. They are the *stigmata,* their business being to receive the farina, which drops from the flowers on the top, and without which the ear would produce no seed; a fact proved by cutting off the top before flowering, the ears becoming barren. This office performed, the tassel and silk dry up and wither. The grains are of various colors, mostly yellow of various shades; sometimes nearly white, and (sometimes) approaching red." Some are of deep chocolate; others greenish or olive; and the same ear may have grains of different colors. The kernels are long, round, flat, or shriveled.

There are two or more leading spstems of botany now in vogue: the Linnean, which for a long time was most promi-

nent, and the Natural system, the adjustment of which has varied in the hands of different scientists. The Linnean ranges the individual plants in varieties, which are gathered into species, the species are reduced to genera, and these to orders, which are arranged in classes, one of which, called *Monœcia*, is founded on the fact that the same *culm*, or stalk, contains the *stamen*, (the tassel above described) and the *pistil*, (the silk projecting from the spike, or ear); the *pollen* fertilizing the ear.

Prof. Lindley's "Natural System of Botany" (1835) has five great classes of plants, the third of which is the *Endogens*, or *Monocotyledonous* flowering plants, characteristics of which are "leaves with parallel veins; stem without any distinction of wood, pith, bark and medullary rays. Flowers usually appear with a ternary division. Seeds in a pericarp. Cotyledons solitary, or if two, unequal and alternate with each other." Part of this class have the flower incomplete (having no distinct floral envelopes, except leaves). Among these are plants with *glumaceous* flowers, which contain the *Graminaceæ*, or *Graminiæ*, (grass tribe), and among these the *Gramina*, or grains. In the above work the reader will find a very full description of the grain tribe in general, and maize in particular. "Lindley's Introduction to Botany," published in 1835, gives a full explanation of the technical terms. The "Vegetable Kingdom," published in 1853, in London, is a work worthy of this Professor of Botany, in the University of that city. He here introduces alliances among his classes, and among the alliances of *Endogens*, are the *Glumales*, the flowers being glumaceous—(that is to say, composed of bracts not collected in true whorls, but consisting of imbricated colorless or herbaceous scales.) Among the natural orders of *Glumals* are the aforesaid *Graminaceæ*, the characteristics of which are an ovary, one-celled, with two or more distinct (or united) styles; ovule ascending;

embryo lateral, naked. Under this head, among the plants of the grass tribe, the Professor gives the substance of his comparisons of the maize with other grains and food plants; which the votary of science will find very important as well as interesting. It may give some idea of the vastness of Nature's variety, to state that this botanist assigns to the order *Graminaceæ* 291 genera, and 3,800 species.

The relation of the varieties of maize to the subject of prices has already been referred to, and their nature as indicated in the course of the historical statements as to that topic, will allow of more brevity in the present discussion.

The most obvious differences between these varieties are those of color, size of ear, number of rows of the kernels, and their external appearance as ranged on the cob. That of color seems to be least affected by the climatic relations of corn culture. The yellow, however, seems to be more natural to the North and the white to the South. This may be mainly due to the fact so generally acknowledged, that the Northern maize contains more oil, and the Southern more starch. The former has more firmness, and perhaps more substantial nutriment. It is thought to be more fattening to hogs; distillers say it is richer in material for their product; it is, perhaps, more generally of a flinty nature; although there are white flints as well as yellow. It is said to be better for shipping, because its more oily substance makes it less liable to fermentation. Some prefer it even for bread, but these seem to be very much in the minority. In grinding, it breaks up into coarser particles, as a whole, although the coarse meal, when the finer particles are sifted out, makes, when thoroughly boiled, that delicacy often called samp. But this coarseness of the meal, as will its less agreeable color, makes it less fitted for bread making; the yeast or baking powder would not reach the heart of its substance so easily, and the taste of the public, in the matter of bread, generally inclines to

whiteness, even in that made of wheat; flour from white wheat being more generally popular than that from what is called red wheat. Many persons complain of the raw taste of yellow corn bread; but for cakes, sound yellow corn is excellent. The Peruvians are said to raise a white variety, coarse and unpalatable as bread material, which is fed to swine. But in the United States, white corn, when it *is* white, more generally brings the better price. There are, however, all shades between white and yellow, and in many cases, grains of both colors will be found in the same ear; and it will be observed that quotations in the great market are, of late, quite as often mixed, as of either of the prime colors. The soil, as well as the climate, seems to have some effect on the color. A correspondent, in one of the U. S. Reports, writing from Jennings County, Indiana, gives it as his experience, that the hardness of the white seed in coming up greatly exceeds that of yellow; and that yellow, if sound, may come up in wet, heavy soil, but not in cold, wet soil. This is in latitude 39°, a very favorable one for maize culture. Another correspondent from Fayette County, Indiana, about half a degree further North, says that more white than yellow is raised, that yellow yields more to the acre, and contains more nutriment. Many years ago a correspondent from Maine described several fancy colors of corn cultivated there, among which were the blood red, described as soft, damp and inferior.

In the South-West, in one of the earlier Agricultural Reports, is described a new variety, called the Calico corn, from the resemblance of its colors to printed cottons, which excited much attention. It was said to make very white flour, resembling wheat flour in its adaptation to bread, cake and pastry making. The Indians in the far West cultivate smaller varieties with a greater number of colors. A late sojourner among the Indians of Arizona and New Mexico,

(see U. S. Agricultural Report, 1870) in describing their culture and uses of maize, says the grains vary in color, through shades of pink, blue and white, and the ears are generally small and slender. Blue varieties are preferred, and sorted from the rest for bread. The Mexicans also use them for tortillas, or cakes. Some of these, grown by the Pueblo Indians, in or near Arizona, are said to be about the same as those grown in Mexico, when conquered by Cortez. A variety of sweet corn, called the Black, and approaching very nearly to that color, was obtained by Capt. Burch, of Marietta, Ohio, from one of the Indians, during a steamboat trip along one of the South-Western rivers. Its cultivation was a success in Marietta, and as a variety for the table, was considered equal to any other of that class. The occasional red ears found in a field of common corn, which were so much prized in the old-fashioned husking bees, are probably among those accidents which cannot be easily accounted for.

Returning to the North-East; among the old varieties were the red blaze and red glaze; the latter producing, it is said, in some cases, six ears on a stalk. Some writers have ascribed the fancy shades, as red, blue and purple, to the colors of the oil contained; others to the epidermis of the grain. The truth of the matter seems to be, that if the epidermis be transparent, the color may depend either on the oil, or on the combined particles composing the grain; "but if the hull be opaque, the grain will present the same color. For instance, the yellow color of the Golden Sioux is derived from the yellow color of the oil, and the Rhode Island white flint corn from the colorless particles of starch and oil, which are distinctly seen through the transparent hulls; but red, black and blue corn owe their lively hues to the color of their epidermis, and not to the oil."—(U. S. P. O. 1853.)

It is said that white and yellow, placed a long distance from corn of other colors, have produced grains of the

brightest red. One writer credits this as the effect of the different portions of iron and other metals acted upon by the rays of light.

A mixture of Brown corn with the common eight-rowed yellow, produced a chocolate color. The *white flour* variety was named from the snow-white flour with which the grains were filled, composed mostly of starch, having little or no oil or gluten. A more recent variety grown at the West, the Snow corn, is probably the perfection of the white among the maize grains, as the Golden Sioux may be of the yellow. White and yellow assist in giving names to a large number of varieties.

The corn proper to the South has an ear of greater diameter than that which has been established in the North. This results from the long seasons of growth which give the stalk an opportunity for growing much taller, and make it necessary to plant it farther apart, in order to let in the sun and air. Fewer stalks being planted in the hill, the limited number of ears, where the other conditions of growth are equal to those of the Northern corn, will necessarily become much larger.

Western corn, being more indebted to the South than the North, although a pretty fair compromise between them, has more specimens of mammoth varieties than the latter.

The number of rows in which the grains are compacted on the ear, helps out the nomenclature of the corns, as well as the differences between Northern and Southern varieties. The eight-rowed yellow is a standard variety in New England and Northern New York ; the ears are often long and slender. The old fashioned Canada yellow was eight-rowed, with a small cob, and was said, in early times, to ripen earlier, and to be more solid than any other varieties except Rice and Pop corn. The early Canada White Flint was also eight-rowed, abounding in oil, and was used mostly for boiling and

roasting ears. These two varieties, as the name indicates, were among the kinds most cultivated in Canada. The Piscataqua, with small kernels and very small cob, and ripening early in latitude 43⅔°, was also eight-rowed. The Brighton was distributed by members of the Massachusetts Legislature, before Maine became a separate State—1820. It was twelve-rowed. One farmer planted this on light land, which he cultivated well, and the result was, nearly all eight-rowed ears. A small variety of the same was put on rich clay land, and it went back again to twelve rows.

The statements here made, in regard to varieties, are mostly gathered from U. S. P. O. and U. S. Agricultural Department Reports, beginning with the small issue of 1842. Some from agricultural journals, and journals devoting more or less of their space to agricultural subjects; a few from other published works on general agriculture. The past, then, comes in for a considerable share of them. The testimony of experienced farmers on this subject is very general, that varieties of maize undergo great and often very rapid changes, at least until the variety has become fixed by a long course of careful and consistent selection of seed, before planting. When it becomes adapted to a certain soil and climate, and care is taken to keep it distinct, and preserve its good qualities, it may not change perceptibly for twenty years. Such has been the experience of several correspondents of the department referred to. But varieties planted out of their proper sphere, speedily change to meet the new conditions in which they are placed. It is very common for Southern planters to use seed from the North for their late planting; or for supplying the place of the early-planted, when cut down in its infant growth by worms, or prevented from making a stand by other unfavorable influences. For the first season or two it preserves its Northern habit of ripening early. But the Southern farmer can obtain fresh

Northern seed every year if he chooses. On the other hand, if the Northerner attempts to introduce the late-ripening Southern seed into his planting, where the late frosts come so much earlier, he will be very apt to get only fodder for his pains. Southern varieties have been made, however, to creep gradually North, so as to infuse by mixing, or otherwise, some of their good qualities into the Northern plant, giving it more bulk, and taking away some of its hardness. Perhaps some of the varieties we shall now mention may be Northern corn with a few Southern principles. The Dutton, with rows differently stated—from eight to eighteen—has a shorter ear and a larger growth than the Brighton; colors, yellow, and white; cob large; the ear sometimes twelve to fourteen inches long; the kernels very thick on the cob; it ripens early, and when properly managed, yields one hundred to one hundred and twenty bushels to the acre.

In one case, two bushels of sound ears yielded five pecks of shelled corn, weighing sixty-two pounds to the bushel. It was introduced by Solomon Dutton, of Cavendish, Vermont. One of the old varieties in Western New York, called the Early Gourd, did not bear so good a character. It was very large, and ten or twelve-rowed: was said to be longer in ripening, with inferior filling out, requiring too much space between the rows on the cob; and did not shell out, or measure as much to the bushel. It may have done better in Ohio, to which it emigrated many years ago, together with the Dutton.

As we go further South the number of rows on an ear increases, that is, in the case of the varieties suited to the climate. The varieties last mentioned were cultivated extensively some twenty or twenty-five years ago in the latitude of Rhode Island, between 41° and 42°. The same range of latitude extends through South-Eastern New York, Northern Pennsylvania, the extreme Northern parts of Ohio, Indiana,

Central Iowa and Nebraska, and the extreme Southern part of Michigan. But it is well known that the climate is not determined by the latitude alone. Much depends on the mountains, which diminish the average heat, and on large bodies of water, such as the Atlantic Ocean and the Great Lakes, which tend to equalize the temperature, softening the rigor of winter, and the intense heat of summer; and very much depends on the direction, power and constancy of the winds. What are called the isothermal lines (lines of equal temperature) were established many years ago, after thorough investigation by men of science, and some of the results are embodied in an article on Meteorology, by Prof. Joseph Henry of the Smithsonian Institute, at Washington City, in U. S. P. O. 1856. According to his description of the isothermal lines, that of the mean temperature of 50° passes a little south of Nantucket, (in about latitude 41¼°) almost directly West, nearly parallel to the line of the 40th degree of North latitude, to about the 95th meridian of West longitude, in Iowa, and then curves more rapidly to the North, meeting the coast of the Pacific in about the 48th degree of North latitude, near Puget's Sound. One of the mean temperature of summer, that of 70°, (so important to the ripening of Indian corn) is exhibited by a line commencing near Long Island, ascending rapidly towards the North, and descending towards the Great Lakes, passing through Lake Erie, reaches its greatest Northern declination at about the 110th meridian (in about latitude 49°) in Northern Montana; and then turns nearly parallel to the coast, and meets the Pacific in the latitude of about 34°. This curve "exhibits the great effect which the vicinity of the Lakes has on the temperature of summer." While the first named line indicating the mean temperature for the year, of 50°, is "not at all affected by the proximity of these large bodies of water, the mean temperature of the summer (70°)

is materially reduced." He draws another line in blue, (the others being black for the year's average, and red for the mean of summer) which blue line denotes a mean temperature for winter, of 30°, only two degrees above the freezing point; starting at the East end of Long Island, passes through Lake Erie, thence down to the 40th parallel—in longitude, about 91°—where Missouri and Iowa corner against Illinois, and thence rapidly rises to the North, and leaves the United States at the 118th meridian, on the North line of Washington Territory. This winter line suddenly bends up, after passing the mountains, towards Lake Erie, "indicating an increase of temperature due to the vicinity of the same reservoirs of water." The other isothermal lines crossing the United States will be hereafter described. This foretaste of the climatic part of our theme is here given as modifying the statements made in regard to the varieties of maize in connection with the latitude of the places referred to.

The Brown corn seems to have been, nearly thirty years ago, one of the fixed varieties, having large kernels and small cob, varying from ten to thirteen inches long. It was highly recommended, and the Patent Office sent out samples of it to different parts of the Union, to test its qualities. It was described in the U. S. P. O. 1847, as growing but five feet high; could be planted in hills three feet apart; the stalks small, and ears near the ground; useful for planting in orchards, as being less affected by shade than other varieties. Its advantages were stated to be—

1. Greater yield from the same cultivation.

2. From its rapid growth and early maturity it was secured against the late spring and early autumn frost, and might be early brought into use or into market.

3. It was very hard, oily, and excellent for shipping.

4. The small size of the stalks made it less exhaustive to the soil; less liable to blow down, and capable of being planted nearer together.

In the vicinity of the Hudson river it was said to ripen early—by the middle of August. Five ears, about ten inches long, shelled, made 2,000 grains, filling a quart measure; and making 64,000 grains to the bushel. In New Hampshire, 135 bushels of shelled corn had been obtained from it, and on an average more than 90 bushels per acre.

The experience of J. W. Colburn, a New Englander, for twenty-four years, was, that the best variety came from a mixture of the common eight rowed yellow with the Brown corn. The Tuscarora Indians, about the year 1853, cultivated at their reservation in Lewistown, Niagara County, New York, a singular maize grain they called the Tuscarora White. They brought it with them, in 1712, from North Carolina, where a corn of the same name was still cultivated, a quarter of a century ago. It had from twelve to sixteen rows; the grains were whitish on the outside. Was said to have neither gluten nor oil, being, except the grain, composed of dextrine and starch. It was softer, and in some respects, better for horses than flint; it was capital for making starch; the meal was apt to sour, but while sweet, made good bread.

The Rhode Island corn was probably so called from its being a favorite, and yielding heavily in that State. The depth and breadth of the grains was about the same, and they were full of oil, which, as well as the hull, was transparent and colorless; and its white meal was less apt to sour than some other esteemed varieties.

In Connecticut, a mixture of the common Dutton with a very large kind of eight-rowed corn, in planting, the whole crop being planted with the two varieties in about equal proportions, resulted in very large and long ears of both kinds, many fourteen inches long; kernels on eight-rowed very large, and cob small—those on the twelve-rowed much larger than those on the common Dutton corn.

In the course of emigration, the New York corn reached

Wisconsin, where, in Grant County, it was said to be preferred; but the experience of the correspondent was, that any variety would adapt itself to the climate in a few years, and his idea was that the longest cultivated was the best. It is pretty evident, however, that it must require very *skillful* cultivation, long continued, to produce an excellent variety out of an inferior one. One of the exceptions to the general fact that white corn has been preferred for human food, was that of a correspondent of the Agricultural Department, from Monroe County, New York, who stated that yellow was preferred for the cornmeal ingredient of brown bread. The flint varieties seem more proper to the North, although they have reached, for partial culture, almost every part of the Union. White flint was said by some to be less injured by the frost than yellow. Others have stated that yellow flint was best for rich bottom land, and was preferred in some spots in latitude 40°, as ripening two weeks earlier than any other variety, and being less liable to frosts. Some have preferred small yellow as being suited for close planting, early ripening and easy husking; and as yielding more corn with less labor, especially in an open season; the average produce on good bottom land, with good culture, being stated as 100 bushels of shelled corn to the acre. One kind of small yellow, however, with a short thick ear, was said to mould easily in the husk, in wet weather.

In Michigan and elsewhere, Northern Dent was in use—two-thirds yellow and one-third white Dent—each kernel being dented at the top. From latitude 42° to 43° the two Dent varieties were gaining on most others above described. A correspondent from Venango County, Pennsylvania (41½°) provided two varieties of seed: one, the best grown in his vicinity, planted, when it could be done, at the proper time; the other, adapted to a cold climate, to be planted when the spring had been unfavorable, or there had been a failure of

the first planting. At Erie, Pennsylvania, (42°) the red cob Gourd Seed was said to be the most esteemed variety. This is one of the Southern varieties which had been making its way Northward slowly, and Westward rapidly. The shape of the grain probably suggested its name. At a somewhat lower latitude, a hybrid between the rough Gourd Seed of the South, and Northern flint was an esteemed variety. The Gourd Seed was said to accommodate itself in a few years to that climate, by becoming dented. The size and number of rows increased. It was both yellow and white; the latter being preferred for horses, the yellow for all other stock. The Delaware County, Pennsylvania, Institute of Science (40°) reported several varieties as being cultivated there, more or less approaching to the Gourd Seed character, a tendency being observed in all varieties, after a few years domestication, to yellow flint—twelve to twenty-four rows—more or less pitted, all varieties there assuming that character eventually.

We have now reached the centre of the great maize zone, the parallel of 40°. Not but what the future may develop a lower parallel; but this seems to be one established for the present by the facts of production. It is hard to say whether the Dent or the Gourd Seed is most prominent here. The flints, of course, either by themselves or mixed with others, occupy a position more or less favorable, North, West and South. The zone of which we are now speaking covers New Jersey, Delaware, Maryland, Virginia, Pennsylvania, Southern Michigan, Ohio, West Virginia, Kentucky, Indiana, Illinois, Southern Wisconsin, Iowa, Missouri, Kansas and Nebraska, and parts of Indian Territory, Northern Arkansas, Tennessee and North Carolina. The central line of this territory is nearer 39°, but the present centre of actual production is probably nearest 40°. In this region, the Ohio valley has done most for maize culture. Many examples

might be given of the readiness with which its corn takes on the habits of the extreme South, as well as those of the North, forming mixed varieties of wonderful productiveness. Many years ago the Baden corn produced a great sensation among the farmers cultivating the Eastern parts of this zone. The method by which this variety was produced was similar to that of others who, of late, have introduced new varieties. The seed was uniformly selected from stalks bearing the most well formed ears. Some of the stories told of the results seemed very large to those whose practice followed the old routine of farming. Probably they were exaggerated; but very unusual conditions may have united to produce those which were true. The method, however, of reaching these specimens of high culture has been generally recommended. Dr. Muse, of Maryland, said of the Baden, that he had tried it for many years, and found it the most productive and heavy variety—that is, the Baden white; but some kinds passing under that name were very inferior. Some of the most approved varieties for this region seem to have been natives of Virginia. Virginia White Gourd Seed had from twenty-four to thirty-six rows. The color always white unless crossed with other kinds. If crossed, it could be known by a small indenture in the grains when perfectly dried. The ears were not very long, nor so large as the Big White. In the *Yellow Virginia*, the kernels were very long and narrow, and of so soft and open a texture that they would not bear transportation by sea, unless kiln dried, or completely excluded from moist air. The grains at the exterior ends were flattened and grew so close together, that they produced greater yield than any other variety, in proportion to the size of the ears. Had more starch and less gluten and oil than the flint kinds. Their oily and glutinous parts always occurred on the elongated side of the grain, while the starch projected quite through to the summit, and

by a contraction in drying, produced the pits and depressions peculiar to their ends. This variety was later in ripening, though more productive, than any other kind. It was good for stock. The Gourd Seed was sweeter and more easily masticated than flint. It worked its way, with some success, Northward to about latitude 42°, and the yellow kind was noticed as being common in New Jersey, Delaware and Pennsylvania, together with the yellow bastard Gourd Seed. New Jersey, also, had the eight to twelve-rowed Jersey White. A variety produced from the Southern Gourd Seed by gradual acclimation was less dented, about half as long, more nutritious, produced sweeter meal, and had a stalk about half the length of the original. The hybrid between Southern Gourd Seed and the Northern flint, was an established corn in this section. The Dent rather predominated in the heavy corn districts, for a considerable time; but the yellow Gourd Seed gained on it, being thought to yield best. In Indiana and Illinois, in addition to these, the Hackberry, White Gregory, Large Virginia, White Gourd and Arkansas Yellow were spoken of as popular varieties, and in Iowa, Yellow Flat. Tennessee adopted the Ohio Yellow, Dutton, large Gourd Seed and Yellow Gourd. Kentucky had a yellow named after her, which was a favorite in Miami County, Ohio, for distillation and swine feeding. There were some nondescripts under the names of Honey Creek, Keever and Bullskin. A yellow in Newport Indiana (40°) was reported as ripening two weeks earlier than any other kind. A yellow variety from Oregon, sent out by the Patent Office, was a favorite with many. Of the yellows, large was stated, by some, to be the best for horses, mules and hogs, and small for neat stock. Several were fourteen-rowed. Some planted yellow, or yellow flint, on thin land, and reserved the white for the best land, including bottom. A correspondent from Hamilton County, Ohio, advised the Cincinnati *Gazette*, in November,

1871, of a specimen of Mammoth Yellow, with thirty rows to the ear, averaging forty grains to a row, in all, 1200 kernels; twenty eight ears weighed forty-four pounds, husk and shell.

The *Smooth White* was said to have a stiffer stalk, less likely to break in high winds than any other variety; a quality very important in a prairie country. A long variety of that kind, ten to thirteen inches, grown on strong land, measured well in wagon or barrel, but required a long season, and was very liable to frost. The New Mexican White, from the Patent Office was reported as planted in Allegheny County, Pennsylvania, in the spring of 1854 with a fair yield. Several correspondents speak of white as requiring the best land, making large ears, with grain broad, deep and lightly indented; and when ground, the meal being white, fine flour. Of later corns, Lloyd's is said to be a great success—the ear eight to thirteen inches long; cob white, one and one-half inches in diameter; covered compactly with sixteen to twenty rows of grains. *Twin* corn, a species of white Baden corn, similar to the old fashioned Gourd Seed; six ears known to have been gathered from one stalk. Some ears of last crop raised upwards of 1200 grains.

Among the varieties to be seen in the Museum of the Agricultural Department at Washington, from Kansas, marked as received in 1869, was a dented kind for feeding, about ten inches long; a yellow from eight to eleven inches long, and two inches in diameter; and one eight-rowed, eleven to twelve inches long, with a white cob; these three coming from the State Fair. Several late varieties noticed in the agricultural columns of the Cincinnati *Weekly Gazette,* were the Iowa Golden Fleece—a magnificent specimen, and Whitecap Yellow, from Butler county, Ohio, cultivated at Tuscola, Illinois, in 1868; in a backward season ripened early, and yielded sixty bushels to the acre, very sound corn; well

adapted to prairie soil. The Large Mammoth grows more than twelve feet high, the large ears hanging too high for a man to hang his hat on; hills not nearer than four to four and one-half feet apart; two stalks to the hill; produces sixty-four bushels to the acre. Earlier and shorter varieties admit of hills three and one-half feet apart, and three or four stalks in the hill. The mammoth ears average thirty rows, and forty grains in the row. New witnesses testify that yellow corn is best for stock; but that the meal having a rawer taste than the white, is less used, and at the South is totally rejected for human food. A correspondent from Newtown, Indiana, writes that a neighbor sold twenty acres of corn to be "hogged down;" six acres of white, the rest yellow; the hogs scarcely touched the white till the yellow was all eaten; both were fully ripened. Another witness from Indiana adds to the statement, that yellow is sweeter and best for fatting, the fact that it makes three pints more whisky (to the bushel) than white. Wayne County, Indiana, produced 60 pounds to the bushel of *Shoe Peg* corn—very "yieldy." The Illinois premium large yellow yields 85 to 90 bushels to acre—very profitable for stock.

J. S. Leaming, of Wilmington, Ohio, advocates Clinton corn for seed, and claims that it is two weeks earlier, two feet lower, bears closer planting, has a larger heart in the grain, feeds farther, has a larger yield to the acre, and is a purer genuine yellow corn than any other known to its patrons. Campbell's sixty days corn, Delaware, Ohio, believed by some to be the earliest sweet corn, has long ears, large grain, small cob and exquisite flavor. Geauga County *Republican* reports 208 bushels, in 1872, raised on one and one-sixth acres of ground, of Sanford corn in that County, without extra culture.

Of the varieties raised South of what has been marked out as the great corn zone, say in latitude 36 to 34°, are

mentioned as popular varieties, a mixture of Gourd Seed and Rareripe, and the Southern Big Yellow, with long, thick cob; grains rather roundish, than deep; the sides falling off to a point where the rows unite with each other, giving the outside ends of the grains a circular form, and the ear the appearance of a fluted column; contains less oil and more starch than Northern kinds, fed to hogs; mixed with other white Gourd Seed. The Southern Small Yellow is of like shape, but the ears are slenderer and shorter, and the grain smaller, outwardly flinty and firm; is earlier, and sooner out of reach of the frosts than Big Yellow; less productive, but more fatting to poultry and swine, and better for shipping. Mixed with Big Yellow, produces Virginia Gourd Seed, and other large varieties. Southern Big White Flint, in shape and size much like Big Yellow, was twelve-rowed, with thick, large cob; had more starch and less oil than Northern flint, was much softer and better for horses. Its meal soured easily, and required kiln drying for shipping. Was less prolific than white Gourd Seed. Double-eared White, between Gourd Seed and Hominy Flint, was firm and heavy. A yellow was described as the result of a mixture of White Virginia with Southern Big Yellow. Large White was highly esteemed for its abundant yield of grain, suffering less from the weevil, and making very sweet and white bread; and of fodder, the blade having more nutriment than new hay, and being the best long feed for horses; the husks, less relished, fed to cows and young mules. These husks were formerly much used for mattresses, being cleaner and more easily moved than mosses; and mixed with coarse cotton, made mattresses little inferior to curled hair. The old fashioned Tuscarora had a large, long, white and heavy ear; the Dearing was sometimes planted with it, in alternate rows; in due time frittering away its tassels, and fixing a large-grained kind on the many-grained Dearing cob. The Tuscarora was

light, large and productive, with chaffy grain; could not, for its large size, be planted thickly; was found cultivated on the settlement of North Carolina. Best hybridized with small flinty corn. A new Tuscarora has a red cob, large reddish and white kernels, soft and easily crushed, and much starch, and little oil. Seventy-five ears as they come to hand, have filled a barrel. The result of an experiment noticed in the Columbia (S. C.) *Advocate*, was said to be, corn measuring in some instances twelve to thirteen inches in circumference and twelve to fourteen inches long; from forty to forty-eight rows of grains on the ear. This was the yield of a single ear to the stalk. The ears which were from stalks bearing six ears or more, were smaller; it was mostly of white Gourd Seed, the varieties from which the selection had been made being thus described. One was remarkable only for grain an inch deep, on a cob of the size of the finger; another for its thick and very short cob, and a third for its long, dry and slender cob. Either of the varieties, regarded singly, or separately, as to its properties, was hardly worth planting; but by suitable blending, they were made to produce the above described mammoth ear.

Several correspondents from the Southern States agree in stating that white is best for hominy as well as bread; has more extended roots; is more easily raised, and best established. Yellow is preferred by some planters, on account of its sound grain, being less apt to rot in the field, and less exposed to the ravages of the weevil. All kinds deteriorate when grown successively in the same soil; change itself being a benefit. The time of ripening was unimportant; every kind planted in May ripening before frost. The weight of the corn was also unimportant; twice as much of the lightest could be raised on the same ground, as of the heaviest; the probable amount of nutrition being about equal in the two cases. Some of the best hybrid varieties have been pro-

duced by impregnating, with the pollen of sweet corn, some Southern farinaceous variety as the parent stock.

The kinds cultivated at Albuquerque, in New Mexico, (34–5°) were most akin to those cultivated in the New England States. The stalk did not average over six feet high; the cob was large, but unusually long The grain was roundish, and the germ of the heart larger in proportion to the rest of the grain, and more nutritious than was generally the case with varieties produced in the States. Of its colors, blue, yellow, white, red and black, blue predominated; that alone being used for tortillas, or corn cakes—the only bread there for the table.

Richard Rouse, of Tappahannock, Virginia, had experimented for sixty-two years, on varieties of foreign and domestic corns, and thought the following corn, as yielding more grain to the acre, and more meal to the bushel, than any varieties he had experimented on, "increased one-half over other varieties." Cob generally red, periphery of kernel partaking of its color. Some of Mr. Rouse's neighbors thought corn on a red cob matured more rapidly than one on a white one.

Of the varieties grown between latitude 30° and 33°, mixed Gourd Seed and flint, and long Gourd Seed were preferred in some quarters. Others thought the Gourd Seed objectionable, from its being infested with insects in the field and crib. The Spanish Creole was much hardier than common Gourd Seed. The St. Antoine was considered by some superior to any other grain, growing sixteen to eighteen feet high; producing on the same soil 25 to 33 per cent. more; standing severe droughts much better; being much larger; but was two weeks longer in maturing, than the Gourd Seed. Early Ohio Flint was said to have a stalk larger than any other variety, and to produce more fodder; was more sure of maturity, and less injured by drought or excessive moisture.

The varieties thus far described, are those commonly consumed on the farm or sent to market.

The Cooley corn was extensively advertised, and sent to the U. S. Ag'l Department to be tested, from which samples were sent to different parts of the Union, for trial. The returns of correspondents, embodying the results, appeared in the issue for 1872. It appeared from all the information obtained, that this corn, because of its early maturity, and its avoiding the droughts of August, so prejudicial to the white corn in the South, and its being more certain of production than large Gourd Seed, though less prolific, was desirable in the Southern States. In the Northern and Middle States, it did not mature much earlier than yellow Gourd Seed, and was far less prolific. The Department also distributed, for trial, samples of the Pennsylvania yellow corn, which had been raised with great success in Eastern Pennsylvania for some years, being early, prolific, hardy, and yielding an abundance of fodder; was a yellow Gourd Seed with a red cob; the ear shaped like the white Gourd Seed of the South, but not quite so large, and very much earlier in maturing. The returns of correspondents who tried it, appeared in the Report for 1872, generally confirming these statements of its good qualities, and commending, especially, its habits of early maturity. The trials seem to have been made chiefly in the Southern States.

A species of maize from Oregon has a separate husk for each kernel. Some have supposed this to be the original maize; but this peculiarity may be accounted for by the efforts of the plant to resist the coldness of the climate; maize being very remarkable for adapting itself to climatic conditions. In the Lake Superior region is found a variety hardly more than two feet high, with little, rounded, pearly grains, flattened and shining, on very small ears. The Mandan corn, (*præcox*, of Nuttall)—very low stem—was success-

fully cultivated by the aborigines on the Missouri and its sources, ripening in a climate where it was supposed no other variety could. The Quarantine is said to ripen in forty days. The Golden Sioux has been referred to; is twelve-rowed, with short, thick cob; the kernel of medium size; was obtained from the Sioux Indians. Rice corn, resembling, in shape, the grains of rice; of different hues; small ear; excels all corns in its quantity of oil, but is so deficient in starch that it cannot be made into bread, being dry, like sand. It doubtless makes fowls lay. Pop corn, the *Zea Curagua* of botanists, also called Valparaiso corn, is next to Rice corn, in abundance of oil and deficiency of starch. It is capital for Christmas parties, when well popped. Corn poppers have been invented to facilitate this process. The American Cyclopedia says the oily principle is seen in the form of fixed oil in dots lodged in six-sided cells, which form the cellular tissue of the seed. On taking a thin, longitudinal section, and submitting it to a high magnifying power; by touching the slide on which the section lies with a solution of iodine, the starch will be colored violet, and the white, oily parts remain uncolored. The compactness and hardness of the kernels, in some varieties, is due to this close, albuminous, oily structure. The ears as well as the grain of Pop corn are small. It easily loses its popping character, when mixed with other corn. As Dr. Jackson says, when the grain is so heated as to decompose the oil, there is a sudden expansion of gaseous matter which ruptures every cell. This takes place at the weakest point of the arch, the whole grain being turned inside out. The cells, under the Microscope, will now be found torn out of shape. Decomposition of the oil forms carburetted hydrogen, with which large cities are sometimes lighted. Tuscarora corn cannot pop.

Dr. Jackson thinks the use of oil in corn is obviously to prevent the rapid decomposition of the grain in the soil, and

to retain a portion of the food till needed by the young plant, and is always the last portion of the grain taken up. It serves to keep meal from souring readily. Flint cornmeal will keep sweet for years, when put up in large quantities. Tuscarora meal, so deficient in oil, is good for rapid cooking; its meal is easily boiled or baked. After the extraction or decomposition of the oil, the substance of the grain is more readily digested by man, though less fattening to animals.

There are many excellent varieties intended especially for boiling, or roasting ears; a few only, will be noticed here. *Sugar* or *Pappoose* corn; said to have been found among the Six Nations of Indians on the Susquehanna, and introduced into Massachusetts in 1779. Generally eight to twelve-rowed; ear small, but well proportioned; kernels densely packed on the green cob, and then rounded and swelling; but when dry, rough and shriveled; cob red or white; grain abounding in phosphates, sugar and gum, and deficient in starch.

The *Darling*, named from its originator, the result of separation and selection for six years; three specimens—(1) white, smooth grain; flavor like common sweet corn; ears seven or eight inches long; fit to boil by 18th of July. (2) Stalk and ear somewhat larger and a week later. (3) Eight-rowed ears, six inches long, ready for boiling by 18th of July.

The *Evergreen*; more recent; very delicious when boiled; small stalk; very productive, ripening early; admits of several successive ripenings in a long season. A variety raised near the Lakes, the seed of which was from India, is one of the testimonies to the fact that the proper Indian corn seldom grew over four feet high; the ears set near the ground, several small ones on a stalk; the kernel of the sweet kind ripening in six or eight weeks.

Many experiments have been made with a view to the establishment or improvement of varieties; here is one to

test the comparative merits of several supposed to be already established. Prof. Daniels, of the University of Wisconsin, gives, in U. S. P. O. Report, 1871, the results of two experiments on Early Dent, Dutton, Sanford, Cherokee and White Australian, and other varieties, with respect to the times of first showing ripe ears, times of harvesting and product per acre. The Sanford was the last that ripened, and was harvested latest, and produced least. The Cherokee was next latest in showing ripeness, but, next to White Australian, was highest in product. This last ripened eleven days before the Cherokee. The Dutton, with two thirds the yield of the Australian, had ripe ears six days before the latter. In another experiment with seven varieties, his results were: *Early Yellow Pop* ripened the 15th of July; yield, 9.24 bushels to acre; *Joint Pop*, September 15th, 14⅔ bushels; *Pearl Pop*, September 15th, 37⅓ bushels; *Blue Australian*, August 27th, 36⅜ bushels. This last was produced from bluish kernels selected from White Australian, a new kind of flint corn, brought to Colorado from Salt Lake about 1866, and was said to have come, originally, from Australia; and to be peculiarly adapted to high and dry situations. The seed, taken from Colorado to Northern Illinois in 1870, ripened in ninety-six days; some of it eight, some twelve-rowed; very soft, and more easily husked than Yellow Dent. Prof. Daniels thinks it shows indications of a new variety of a character not yet fixed. Another experiment to ascertain the best time of selecting seed, resulted in favor of ears selected at the time of husking, as against those from first ripe ears, the product of the latter being about one-eighth less.

Among the foreign varieties, the Chinese Tree corn was, many years ago, introduced widely; was said to develop in eleven days from planting, and when matured, to yield more than most varieties, making the sweetest and best meal; abounding in leaves for the very best of fodder; and when

sown broadcast for fodder, said to be sweeter, less liable to mildew, and, for the same soil and circumstances, worth 25 per cent. more than other varieties. These commendations appeared in the U. S. P. O. 1847.

The Chinese were said to call maize, *Ya-chu-chu*; the Japanese, *Nanbamthbi*, (corn of new bran) outlandish corn. The leading kinds in Mexico (see U. S. P. O. 1847) were these:

1st. *Maiz de padus*, the least important, with small eight-rowed ears.

2d. *Maiz manchado Chinesco*; productive; having white, yellow and red kernels, and sometimes blue.

3d. *Maiz blanco*—very productive.

4th. *Maiz amarillo*. There are two varieties of this: *grueso*, yields 300 to 600 fold; *pequeno*, smaller, less stout, but in a fruitful soil, returns 10 to 15 cwt. more than grueso. *Tardio*, or *riego*, most productive of all; cultivated around the City of Mexico, and in many moist districts.

In Peru, two leading kinds are cultivated:

1st. *Maiz blanco*; white corn with very large, coarse, inferior grains, rank and strong; for fattening pigs.

2d. *Maiz amarillo*; yellow, large and fine; makes sweet bread.

Chili corn has five good sized ears, set high on a single stalk; needs rich land and high culture.

In reference to European varieties, Wilson's Cyclopedia says that one hundred and thirty varieties were known in Spain. The French cultivate a variety resembling our Large Yellow. There is a large red resembling this in other qualities than color. *Maize quarantine*, to some degree, is raised in England, where it is called the Forty-days corn. In lower latitudes, such as the maize district of France, it is said to require three months. Cobbett's Indian corn is probably the Quarantine. As Lawson describes it, it has a stalk about two feet high; an ear averaging four inches; grain

yellow, and smaller than that of other varieties. Egyptian maize, or chicken corn—in French, called *maiz a poulet*—is very small, and very nearly like Cobbett's. These two, in 1853 were said to be the only varieties fitted for field culture in England. The other varieties mentioned by Wilson are well known in the United States.

One of the most important distinctions between maize varieties, is that of composition. This will be best illustrated by the subjoined tables, as well as by some in previous pages. In reference to the phosphates, one of the most important of the mineral or inorganic elements, (see U. S. P. O. 1853) Mr. A. A. Hayes, of Roxbury, and Dr. Charles T. Jackson, of Boston, Massachusetts, found that if a "watery solution of blue vitriol (sulphate of copper) be applied to a kernel of corn, longitudinally split, the germ, or 'chit' only, becomes colored green, thereby beautifully defining the limits of the phosphates, by the formation of phosphate of copper." "If a grain of corn be split open, as above described, and thrown into a solution of sulphydrate of ammonia, the chit will be changed to a dark, olive color, which arises from the change of salts of iron into a sulphuret of that metal; a dark colored matter forming with the ammonia, turns the vegetable coloring matter yellow, and the two colors combined produce an olive." By preparing grains as above, and soaking in a tincture of iodine, the starch will show an intense blue, and the dextrine deep port wine red, and both being present, a rich violet. Extract the oil through alcohol or ether, from the horny part of the corn, and the tincture of iodine will show the starch in the part containing the gluten. Take an ear of corn having on it grains of two different varieties, as Tuscarora and sweet corn, slit the seeds and dip them in the same solution, and the sweet will show more than double the quantity of phosphates seen in the Tuscarora; the two kinds having derived unequal

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amounts of phosphates from the same sap, derived from the same soil. So a crop of sweet corn will take twice as much of the phosphates as the other variety, and will sooner exhaust the soil of them The superabundance of the phosphates in Indian corn is sometimes apt, it is supposed by some, to supply an excess of bony matter, producing stiffness in the joints of animals fed too freely on Indian corn.

Mr. H. Piper, of Biddeford, Maine, explains the hybridizing of plants, (see U. S. P. O. 1867) as consisting in the fertilization of one species, or one of its varieties, with the pollen of another species, or one of its varieties, of the same or a different genus; the offspring being a hybrid, or mule. Cross-breeding between plants consists in fertilizing one variety with the pollen of another variety of the same species. He gives special directions as to the proper time and manner of effecting this successfully. Great care and skill are doubtless requisite, however, in the attempt to blend varieties; as the mere mixing on the same ear, of those not sufficiently harmonizing in development, may only embarrass the movements of vegetation.

Among the varieties of corn mentioned in an article by Mr. Bollman, in one of the U. S. Reports, is the Horsetooth (another name for White Gourd Seed)—thirty-two-rowed.

He maintains that the less the number of rows, the more flinty; the greater the number of rows, the less flinty; that the largest kinds are not so productive, as to quantity per acre, the smaller and medium kinds yielding most. The close planting of the North is contrasted with the wide planting at the South—four and one-half to five feet apart being the common distance in Tennessee.

In selecting seed corn, it is better taken from the latitude where planted. Small early varieties that yield large crops in the Eastern States, as the Improved King Philip, often yield but moderate crops in the West, and quickly run

out. But Cherokee County, Alabama, was reported, in 1855, as raising two crops of Early Dutton on the same land, in the same season.

The following lists of varieties of maize include many of the specimens seen in the Museum of the Department of Agriculture, at Washington City, in 1876; the officers in charge stating that a large part of the samples belonging to the Museum had been removed to the Government building on the Centennial grounds, at Philadelphia. The length and diameter of the ears is only given as an approximation, from a near view, and not from actual measurement.

XXXVIII.

Kinds.	Length of Ear, inches	Diameter of Ear, inches.	No of Rows	Color, &c.
Eight-rowed Black	10	1½	8	
Purple	11 to 14		8	
Amber	8		8	
Yellow Flint	9 to 14	1 to 1½	8	
Sparkled	11	2½	14	
do	13	2½	24	
White	12	2½	14	
Sparkled	9	2½		Flinty.
White Flint			8	
Flint			12	
do	10	1¾	8	
Sugar			12	Very early.
Sweet	10	2 to 2½	16	
Amber Rice			10	From Ohio
Amber Flint	9		18	
Red	8 to 12	2 to 3	12 to 20	
do	15	1½	12	
Pop	6 to 8	1		
Eight-rowed				From Columbus and
Flint—white cob	8		24	[West Jersey.
Dent	11 to 13		24	
do		1½ to 2	24	Kentucky.
do	12		18 to 20	Red cob
do	11		18 to 20	White cob—Ky.
do			18	Flinty—reddish.
do	9	2½		White—red cob.
do Yellow				Iowa.
do do		1½ to 2½	12	Red cob.
do White				From Milford, Ohio.
do Flinty	11	2 to 2½	14	
do White	11	2 to 3	20	
do	10	2⅔	20	
Dark Red	7	2	14	
Baden	9		12	Dented—1869.
Squaw	9 to 13	1½	8	White and black.
Dent				From Milford, Ohio.
do White	9 to 13	2½	18	do do do

XXXIX.

Names.	Length of Ear. Inches	Diameter of Ear. Inches.	No. of Rows.	Colors.	Whence received, &c.
Dent...........	12	2 to 3	20	High Yellow........	Preston County, Pa.
do	11	2 to $2\frac{1}{2}$	20	....	Crawfordsville, Ind.
do	9 to 12	Large	grains.	White and yellow	Pine Mountain farm.
do	....	....	....	White	Crawfordsville, Ind.
do long.....	14	$2\frac{1}{2}$	18 to 20	Yellow	Milford, Ohio.
do red cob	Flinty.	....	18 to 30	Yellow	....
do do	12	3	24 to 30	Light yellow........	....
do	10	$2\frac{1}{2}$	Yellow	& reddish brown.	....
do Brooks..	11	2	12	Yellow	Flinty.
do	11	....	....	White	Flinty—red cob.
Gourd Seed..	10	2	20	White	Red cob.
do ..	7 to 8	$1\frac{1}{2}$ to 2	....	Blue and yellow...	Mixed.
do [1870..	10	2 to 3	16	White—white cob	Highlands.
Stowell..... } Evergreen }	10	$1\frac{1}{2}$ to 2	....	Shriveled..........	Columbus, Ohio.
Blue, white.	red and	yellow..	24	Mixed on ear....	....

In addition to these were the Prairie White Bread, from Illinois; Caragua corn, very large white, with kernel rather flat; Hobson corn, long, narrow kernels; Dutton, with broad, flat kernels, nearly circular; and Giant corn from Franklin County, North Carolina, eight to ten inches to a joint, the stalk two and one-half inches in diameter, and with four ears on it.

Three ears of corn shown by W. D. Bailey, and obtained from Judge Wm. R. Putnam, of Washington County, Ohio, in May, 1876, may be described as follows:

No. 1, Triple corn, about nine inches long, one and one-half inches in diameter; white cob; eight to ten-rowed; kernels flat, roundish, dented, flinty; small cob; three ears to stalk. No. 2, Dented, ten to twelve inches long, two to two and one-half inches in diameter; eighteen-rowed; kernels yellow at sides—white at top; longish, closely-packed grains; red cob. No. 3 has oblong kernels; dark red, with spots in streaks of deeper red.

The following list of varieties mentioned in U. S. P. O. Reports, in various counties of the United States, with average latitude, colors, number of rows, year of mention, &c., may give some idea of the history of varieties. The

capital letter *Y* stands for yellow; *W*, for white; *G*, for Gourd Seed, and *F*, for flint. The aim is to give the central latitude of the respective counties.

XL.

County and State.	Av. Lat. Degrees	Color.	No. of Rows	Year.	Qualities.
St. Lawrence—New York...	44½	Yellow	8	1848	Preferred.
Winnepisseoge— N. H.	43⅔	do	8	1853	Brown corn.
Rockingham—New Hamp.	43¼	do	8	1853	Flint.
Ontario—New York..........	42⅞	do and white	8	1850	Dutton.
Grant—Wisconsin..............	42¾	....	....	1853	New York corn
Madison—New York..........	42¾	White & yellow	8	1848	Flint.
Wayne—Michigan	42¼	Yellow	8	1849	Dent.
Erie—Pennsylvania	42	Gourd Seed......	....	1850	Red cob.
Barnstable—Massachusetts.	41⅔	Yellow & white	....	1850	Canada.
Venango—Pennsylvania.....	41½	....	....	1853	Early and late.
Adrian—Michigan	42	White & yellow	....	1853	Dent.
Hillsdale— do	42	Yellow Dent . .	....	1850	Red cob.
Litchfield—Connecticut.....	41¾	White & yellow	8	1850	Large.
Bradford—Pennsylvania.....	41¾	....	8	....	Preferred.
LaPorte—Indiana..............	41⅔	White & yellow	....	....	Flint.
Elkhart— do	41⅔	White..............	....	1850	Red cob.
Scott—Iowa	41⅔	Yellow	....	....	Dent.
Washington—Rhode Island	41½	White-cap........	....	1850	Large & small.
Bridgeport—Connecticut.....	41⅙	White & yellow	....	....	Large.
Brooke—Virginia	40½	Yellow	....	1847	Ripens early.
Miami—Ohio....................	40	White & yellow	....	....	Large.
Delaware—Pennsylvania ...	40	Yellow	12-24	1848	Pitted.
Oxford—Ohio	39½	White Dent	....	1871	Mammoth.
Belpre— do	39	Yellow	35	1874	Crowfoot.
Adams— do	39	White G Seed.	....	....	Equal propor'n
Brown— do	39	Yellow	....	1867	Small.
Madison—Illinois......	38⅞	White & yellow	....	....	Flint and G.
Dorchester—Maryland......	38½	do	....	1850	....
Jefferson City—Missouri....	38½	do	....	1850	....
Scott—Kentucky.....	38¼	White & yel. G.	....	1850	Flint.
Woodford—Kentucky.........	38	White G.	....	1850	Flint—large.
Amherst—Virginia	37½	G. and Flint....	....	1850	Double-eared
Buckingham—Virginia	37½	W. & Y. G. flint	....	1851	Nansemond F.
Mercer-Kentucky	37⅛	White & yellow	....	1853	Late - large.
Warren—Virginia	37⅞	do	....	1848	W.—for home.
Cumberland - Virginia	37½	....	....	1850	Tus. & Dearing.
Jonesboro—Illinois............	37½	White Flint. ...	....	....	Deep grains, &c.
Franklin—Virginia	37	Gourd Seed F...	....	....	....
Jacksboro—Tennessee........	36¼	White	....	1848	Flat.
Halifax—North Carolina.....	36¼	White..............	....	....	....
South Carolina..............	32-35	....	....	.	Tuscarora flint.
Sante Fe, New Mexico	35⅙	....	....	1851	New Eng. varie-
Hinds—Mississippi	32⅙	F. Gourd Seed..	....	1850	[ties.
Barbour—Alabama	31⅞	White..............	....	1850	....
Alabama	30-35	....	....	1850	Early O. flint.

In accordance with the instructions of the Commissioner of Patents, to determine the percentage of starch, dextrine, gluten and oil contained in the grain of the King Philip, Tuscarora, Wyandott and White Gourd Seed, or Horsetooth

corn, Dr. Charles T. Jackson procured well characterized samples and analyzed them chemically, and in addition, determined the proportion of caseine, albumen and glucose in the same grains. In one instance the analysis was entirely repeated on a fresh sample of King Philip corn raised the previous summer, the first analysis having been made on dry seed corn. The results of these analyses, which appeared in U. S. P. O. for 1857, were as follows:

ORGANIC ANALYSES OF VARIETIES OF INDIAN CORN IN 1857.

By Dr. C. T. Jackson.

XLI.

Kinds, and State whence derived.	Water.	Oil.	Gluten.	Dextrine and Glucose.	Caseine and Albumen.	Starch.	Cellulose.	Undetermined Ash, &c.
Wyandott, from Washington	15.3	3.6	4.8	1.65	3.0	62.0	6.3	3.3
Tuscarora, from Massachusetts	8.2	3.5	4.8	1.7	3.0	66.3	11.5	1.0
King Philip, from Rhode Island	10.0	4.0	5.0	1.5	2.0	63.6	12.8	1.1
do do Massachusetts	12.9	4.2	5.5	1.5	2.1	54.5	17.3	2.0
Gourd Seed, or Horsetooth, from Virginia	18.2	2.9	2.1	2.65	1.35	53.5	17.5	1.8

Two of these have already been described in the previous pages. The Doctor gives a very particular description of all of them, in connection with his report. The King Philip was eight rowed, of moderate size, long ears, slender and uniform in size from base to top; of deep orange color, flinty, and very prolific. Keeps sweet when ground into meal; not suitable for starch making, nor for rapid cooking, since it is very difficult to soften by water. The sample was obtained from Braintree.

The Wyandott was a corn of extraordinary beauty; perfectly milk white; twelve-rowed, of medium size; the grain was very soft and starchy, having little cellulose in the form of epidermis and oil cells. "Grows admirably in the Southern and Middle States, and is especially adapted to the

manufacture of starch,'' affording 50 to 60 per cent. The teeth of horses and cows can easily crush it, and its meal is easily cooked into puddings and bread, and almost wholly digestible. But its meal, like that of the Tuscarora, is more apt to become musty and sour than that of the flint kinds, and should be kept in the ear until wanted for grinding.

ANALYSIS OF WYANDOTT VARIETY OF MAIZE.

Water, separable at 212°,	per cent,	15.30
Fat oil, soluble in ether,	"	3 60
Gluten, or Zeine, soluble in alcohol,	"	4 80
Dextrine, soluble in water, &c.	"	1.40
Caseine, precipitable by Acetic Acid,	"	2.00
Albumen, coagulable by heat and alcohol,	"	1.00
Glucose, (grape sugar)	"	.25
Starch, deposited from water,	"	62.05
Cellulose, insoluble matter,	"	6.30
Undetermined Ash, &c.	"	3.30
		100.00

The Tuscarora variety analyzed by Dr. Jackson, was from near the borders of Connecticut river, and of the crop of 1856. It was eight-rowed, with very large grains and very small red cob; white kernel, but less pure than the Wyandott; raised extensively in New York for starch. Although rather a late crop there, it ripens in seasons of average length and temperature.

Gourd Seed, or Horsetooth, from Virginia—crop of 1857. The former name from its resembling Gourd Seed, having a prolonged husk; had not been so thoroughly dried as the Tuscarora and Wyandott, which accounts for the larger quantity of water it contained.

It will be observed that the proportions of the nitrogenous matters, to those not containing nitrogen, are smaller than in the tables given in the first analytical tables including maize in this work. Dr. Salisbury's analyses give a larger propor-

tion, corresponding more nearly with those of other analysis, and very generally quoted as containing the true proportions, which will follow the subjoined analyses of corn cobs (made by Dr. Jackson) of different varieties of maize. The first * was an admixture of two varieties of Canada and Red-cap. The matter soluble in ether, alcohol and water was found to be in the following proportions: In 100 grains of the ground cob, the whole amount dissolved was 3.145 grains, or about 3⅛ per cent of cob.

A siccative yellow, fixed oil, . .	per cent. or grains,		0.323
Sugar, ...	"	"	0.242
Dextrine, gum, some albumen and extr. matter,"		"	2,557
			3.122
Loss			0.023
			3.145

* From Rhode Island—for ash from 1,000 grs. burned, see table on next page.

The saccharine matter was not crystallized, and was probably identical with grape sugar, or glucose.

The importance of the cob analysis results from the divided opinions of agriculturalists as to the profit of grinding up the cobs of ripe corn with the grain, in order to make the feed go further; some maintaining that the feeding value of the ear is greatly increased by grinding both together; others, that the cob is only fit for fuel; and others, that the question is not so much the additional nutriment, as that increase of bulk in the food which is most favorable to healthy digestion. The greatest value of the cobs, as feed, is probably when the ears are only nubbins, and not dead ripe; cattle will then eat them greedily without grinding. An analysis of the unripened ear, grain and cob separately, in this view of the case, might be an advantage.

Analysis of the cob of Burr's improved, wrinkled sweet corn—early, cob short, &c.—produced 3¾ per cent. of matter soluble in alcohol and boiling water, of which 0.179 per

cent was siccative matter; 0.065 sugar; 0.242 brown extractive matter; Dextrine, gum and albuminous matter, 3.257; in all, 3.743 (from 100 grains of cob.)

ANALYSIS OF ASHES OF COBS OF THE FOLLOWING CORNS.

XLII.

	Per cent of cob.					Grains.
	Sweet Corn.	Maryland White.	Southern Red Cob.	Tuscarora Cob.	Dutton.	From Rhode Island.
Potash	0.2581	0.4585	0.450	0.6430	0.410	3.201
Soda	0.2104	0.1211	0.220	0.1970	0.174	0 492
Silica	0.1250	0.1720	0 103	0.0714	0.135	0.800
Phosphate of Lime	0.0521	† 0.0800	† 0 054	....	0.042	1.000
do of Magnesia	0 0279	....	....	.... 0.0800	0.020	0.260
Oxide of Iron	0.0416	0.0420	0.032	....	0.038	0.360
Phosphoric Acid	0.0290	0.0290	0 091	0.0800	0 023	0.300
Chlorine	0.0292	0.0340	0.011	0.0630	0 049	0.196
Unburned Carbon	....	0.2242	....	0.1430	0.127	1.500
Carbonic Acid & coal	0.0812	‡ 0.5872	‖ 0.389	§ 0.6590	‡ 0.255	‡ 1.388
Totals Ashes	0 8545	1.7480	1.350	1.9364	1.353	9.500

* Oxide of iron, carbonic acid, and loss. † Phosphate of lime and magnesia.
‡ Carbonic acid and loss. ‖ Unburned carbon and carbonic acid.
§ Oxide iron, carbonic acid and loss.

The cob of sweet corn weighed 480 grains—ashes, 4.2 grains; of Maryland White, 290 grains—ashes, 4 grains; of Southern, 560 grains—ashes, 7.6 grains; of Tuscarora, 630 grains—ashes, 12.2 grains. Of Dutton, 830 grains, three hundred of which dried and powdered yielded on analysis:

Matter soluble in ether, alcohol and water, about 3¼ per cent of the cob.

Fixed drying oil.	grains or per cent,		0.249
Sugar, ...	do	do	0.333
Dextrine, (gum) albumen and astringent extractive matter, ...	do	do	2.700
			3.282

Dr. Salisbury regards Golden Sioux (a bright yellow twelve-rowed, passing into fourteen rows) as an improved variety of Buel's Dutton, ripening earlier and having a smaller kernel. The white flint was grown on a clay loam, and manured in hill with mixed coal ashes and horse dung, and ashed with unleached ashes twice.

PROXIMATE ORGANIC ANALYSIS OF FIVE VARIETIES OF MAIZE.

By. Dr. J. H. Salisbury, of Albany, New York.

XLIII.

	Golden Sioux. Per cent.	Ohio Dent. Per cent.	Small 8-rowed. Per cent.	White Flint. Per cent.	Large 8-rowed Yellow. Per cent.
Starch	36.06	41.85	30.290	40.34	49 22
Gluten	5.00	4 62	5.600	7.69	5.40
Oil	3 44	3.88	3.900	4.68	3.71
Albumen	4 42	2.64	6.000	3.40	3 32
Casein	1.92	1.32	2.200	0.50	0.75
Dextrine	1.30	5.40	4.615	2.90	1.89
Fibre	18.50	21.36	26.800	18.01	11.96
Sugar and extractive matter	7.25	10.00	5.200	8.30	9 55
Water	15.02	10.00	13.400	14.00	14 00
Totals	100.05	101.07	98.005	99.72	99 80

ANALYSES OF THE ASH OF WHITE FLINT CORN.

By Dr. J. H. Salisbury.

XLIV.

	Cut, August 22d.		
	Ash of Kernels.	Leaves.	Cob.
Silica	9.500	53 550	13.600
Alkaline and earthy phosphates	35.500	19 250	23.924
Lime	0.160	6.092	0.300
Magnesia	2 410	1.250	0.900
Potash	23.920	12.762	35.802
Soda	22 590	8.512	5.914
Chlorine	0 405	9.762	0.132
Sulphuric Acid	4.385	4.185	0.345
Organic matter	0.367	....	2 314
Carbonic Acid	....	....	6 134
Total	99.237	101.371	89.365

The above shows that the same plant may take up and assimilate a greater amount of inorganic matter under some circumstances, than others. This corn, besides being supplied with manure of the horse, mixed with coal ashes in the hill, was ashed with unleached ashes. Result, very sound, hard grain.

In the table of Dr. Salisbury's organic analysis, the large eight-rowed yellow had the most starch, the analyst remarking that part of it may be set down as adhesive albumen. The nitrogenous elements are probably 12 per cent. The proportion of sugar is nearly that of Ohio Dent, which has the largest. The white flint has considerably the most oil, although third in amount of starch, and has nearly 12 per cent. of nitrogenous matters; gluten being the largest of them, and larger than in either of the other varieties. Take it all round, this is probably the richest of the specimens. The small eight-rowed yellow has much the most nitrogenous, or technically nutritive matters, (the amounts of albumen and caseine being especially large) and much the least starch and sugar. Its fiber is much the largest. These corns seem to be all from the North, except the Ohio Dent. On the other hand, Dr. Jackson's specimens are all of Southern or Western origin, except the King Philip; the Tuscarora, though raised near the Connecticut river, still showing strongly marked Southern qualities. The assertion that it had neither gluten nor oil, (referred to in page 146) is here negatived; although the amount is quite small, compared with that of some other varieties.

Dr. Salisbury is pre-eminent as an analyst. His chemical investigations, in connection with the maize plant, covered two hundred pages in the volume for 1848, of the New York State Agricultural Society, for which the society awarded him a premium of $300. The analyses of maize in Prof. Emmons' "New York Agriculture" are by Dr. Salisbury.

The above account of sayings and doings, as to the varieties of maize, is strongly suggestive of the greatness, past, present and to come, of the United States as an agricultural region. Here is a plant, which, at the sources of the Mississippi farthest North, hardly grows over two feet high, with an ear scarcely larger than the smallest finger,

which goes on Southward increasing in stature, till near the mouth of this "Father of waters" it reaches the height of eighteen feet. The ear begins on the coast of Maine with the predominating eight rows, and in its South-Western progress towards the Gulf takes on more and more, till in some places it has attained forty. Going West, it has put on nearly all the shades of color in turn, from snow white to light red, and from golden yellow to pure black. In its different varieties, and different stages of growth, it makes the humblest and grossest of domestic animals an efficient worker in producing the cured meats that are acceptable in all lands, and the herds that roam over our pastures abound in the milk and butter that are a source of cheer on all our tables, and supplies the choice luxury of our summer harvests and winter holidays. But the best of it is that, when well conducted, its culture in different forms, and in its many varieties, helps out all other growths prized by civilization. The importance of the subject of varieties is evident from nature's great fact that every plant produces its like, or from those best of words, that "a good tree brings forth good fruit." The value of a full range of facts and theories, from which to deduce conclusions is also evident from that old proverb so true in all kinds of republics, and especially that of science, that in a multitude of counsellors there is safety. But every farmer should so study them as to form his own conclusions, for the simple reason that the conditions of his crop may be in some respects different from all others known to him. And herein appears the value of a long continued culture of the same tract of land. Good eyes well used, and a clear head may make the cultivator, of twenty or thirty years continuance, very familiar with the capabilities and wants of any given number of acres which he has tilled thoroughly. And if he uniformly selects, at the best time, the best seed from his own harvest, and preserves it in the best manner, and plants the

best portions of it, and has a good variety to begin with, he will go far towards producing the best variety for his farm. But his best seed may, in some cases, be improved by a blending with other choice varieties; and the changes of the seasons often make it important to have two different plantings, an early and late one, and in very unfavorable seasons to have a variety not suited to the habits of his own choice variety. In trying a new one, he will be safe in beginning on a small scale. But a first trial may not determine the value of the new seed, even for his own land, much less its average value. The merits of a variety very widely advertised will probably be fairly tested much sooner than one that passes quietly into a few hands. But of course there is danger of counterfeits, where the true variety is a good one. As it is the fashion of advertisers to make the best of their own hobbies, and there may be a dozen in the market, each one of which is claimed as the very best, it might be well for a club of farmers in the same neighborhood to do a little experimenting on all of them that promise to be genuine, and so lessen the difficulty of selection, by division of labor. The Agricultural Department, at Washington, often does the farming interest great service, by securing a fair trial for new varieties, on a scale very widely extended.

As a recapitulation of the conditions which affect the value of maize varieties, may be mentioned the climate, the surface and the soil of the given region; the height and robustness of the stalk; the size, color, shape and composition of the grains and the cob, the number of rows in which they are arranged, and their capacity of withstanding early and late frosts; their fitness for the various uses already or hereafter to be described, and for preservation and transportation.

Their capacity for producing the best and richest fodder, green or dry, is also an important element in the best varieties.

The tendency of different corns planted near each other to intermingle, has been very generally remarked. When a good variety has been established, great pains should be taken to keep it pure and unmixed. Two cornfields planted with different varieties should be widely separated, unless the farmer desires an intermixture. It has been said of pop corn especially, that if planted in the vicinity of other corn, it will be apt to lose its peculiar character. The old rule is nowhere more applicable than in the matter of seed corn, "prove all things, and hold fast to that which is good."

At the experimental farm of the University of Wisconsin, in the fall of 1871, "characterized as a dry season, 100 lbs. in the ear of each of the seven varieties of corn named below, were taken at husking, then in good cribbing condition, dry enough to allow 500 bushels to be stored in a good crib without risk of heating, or moulding," and the whole dried on a loft. Corn shelled Jany 2 and 3, 1872, dry enough to put in large bins without damage. The following table gives weight per bushel of corn in the ear, at storing and shelling, with proportion of shelled corn &c.

XLV.

Varieties.	Corn in the ear at husking, lbs.	Pounds ears at time of shelling.	Pounds of shelled corn. Jany 2, 3, 1872.	Pounds of ears required at husking to produce 56 lbs. shelled corn	Pounds of ears required to produce 56 lbs. of shelled corn, Jany 2, 1872.	Percentage by weight of shelled corn, to corn in ear at husking.	Percentage by weight of shell corn to corn in ear, Jany. 2, 1872.
Ear y Yellow Dent	100	97¾	80	70.00	68.45	80	82
Dutton.	100	97½	75	74 66	72.82	75	77
Cherokee	100	92¾	73	76.71	71.15	73	79
White Australian	100	96	80½	69.56	67.38	80½	84
Sanford	100	91½	72	77.77	71.15	72	79
Pearl Pop	100	96¼	76¾	73.02	70.18	76¾	80
Joint Pop	100	93¾	74	76.19	70.47	74	79
Average.	100	95	76	73.69	70.23	76	80

The Cherokee and Sanford varieties are late at this place, the Sanford giving but a moderate yield.

CHAPTER VII.

USES OF MAIZE—I, FOOD—II, SUGAR AND SYRUP—III, WHISKY. IV, STARCH—V, OIL—VI, MATTRESSES—VII, PAPER.

I, FOOD.

(*a*), *Food for the soil.*—The culture of the maize plant is capital for the soil. This is evident from the analyses which have been given of the stalk, leaves and cob, and of the ash of the grains. These contain large proportions of potash, soda, phosphoric acid, silica and magnesia, and smaller ones of lime, iron, sulphuric acid and chlorine. Especially do the breaking up and turning over, mellowing and repeated stirring of the corn field, make it receive more largely than fields of other grain, the elements of growth from without, and modify its own native stores within, to subserve the uses of cultivated plants. Then it is sometimes sown thickly, to be plowed in like clover and buckwheat. Green and ripe stalks, plowed under, not only restore fertility to the soil, but make it light, porous and mellow. A farmer in Orleans County, New York, preferred it to clover for this purpose. When sown for a soiling crop, or exclusively for fodder, the ground is filled with roots, which, broken up after harvest, make capital provision for the next crop. Even the stubble of a regular grain and fodder crop may be made too valuable for keeping up the soil, to be removed by burning. Of two neighboring Illinois farmers, cultivators of corn, A gathered every year, his cornstalks in a pile and burned them; and, also burnt over his stubble before plowing. B never allowed a stalk or straw to be burned, but always plowed it under; and after fifteen years the yield of A's crop was less, by fifteen bushels to an acre, than when he began cultivating it. B's

crop was as abundant as at first. Indian corn, being a gross feeder, has a great advantage as a renewing crop. It is not at all dainty as to amount or quality of the usual fertilizing substances, supplied at the proper time. Yet it can be poisoned by the excess of certain very concentrated manures. It is very common in some places to give the barnyard and other coarse manures, for a whole rotation, to the corn crop. The waste stalks left by cattle in consuming their rations of fodder, are excellent as absorbents and preservatives of liquid manures. Sometimes they are corded up, after being under feet of the cattle, in layers with other fertilizers, and kept wet with manurial liquids; sometimes mixed in stables with droppings of the cattle, and thrown down into a manure cellar. Often the cattle yard is so excavated, as to throw the liquids into the center, where the waste stalks and other refuse are crowded. Corn fed to hogs is a great source of manure. No animal is more skillful or industrious in composting manures, when supplied with proper material.

Some twenty-five years ago, the U. S. P. O. Commissioner issued a series of questions to his correspondents, including one as to the average result of swinish activity in making manure, while consuming a specific amount of corn. Monroe County, New York, answered, that manure from hogs consuming ten bushels of corn, increased the crop two to three bushels, according to one statement; and according to another, 15 to 20 per cent. That is, if a hog was bedded with sufficient straw or other vegetable refuse to absorb the entire product of the animal, and was properly secured against the elements, and the manure thus made was judiciously applied to an acre of corn on poor or worn out land. From a warmer latitude it was reported that twenty bushels of corn, consumed by hogs, produced ten loads of manure, adding to the crop 25 to 30 per cent. From Ashland County,

Ohio, was reported a gain of two bushels to the acre. From Talladega County, Alabama, the manure from twenty bushels fed to hogs, was reported as adding 60 per cent. to the crop on an acre. A statement from LaPorte, Indiana, goes more into detail. A full grown pig being enclosed in a yard about eighty days, consuming ten bushels of corn, with no drink but water; the whole yard being under cover, and secured from drainage; muck supplied to receive all droppings, liquid and solid, which in ten days are removed to a heap, under cover, and replaced by muck in the yard, which at the expiration of the next ten days is also removed to the heap, and so on till eight loads are saturated; and after slight fermentation applied to half an acre and covered; as the result, that half acre is supposed to produce ten bushels more corn than the adjoining half acre unmanured; thus making the value of the manure from the hog in proper condition, equal to the cost of the food.

It is evident that the effect on the crop, of the manure so made, would be modified by the breed of the hog, the quality of the corn, the climate, the season, and the quantity and manurial value of the vegetable matter worked up, and the manner of its application to the land.

Another use of maize in improving the soil, where land is cheap and labor dear, and the market not so accessible as to render the crop profitable as corn, is the practice of "hogging down." In some of the Western States this is quite common. A Missourian after stating from experience and observation, his belief that no ground or cooked corn would fatten hogs faster than green corn in the field, just after the milky stage, adds, that he had raised eight successive crops of corn on the same field, and fed it down with hogs; the last the heaviest he ever saw.

The hogs are turned into the fields when it is not too wet. Some turn in the cattle first; the fields being either sepa-

rate originally, or made so by temporary fences. The cattle devour what they wish of the corn, and the best of the fodder; often eating cob and all, when the corn is soft. They are then changed to another field, and the hogs turned in to clean up after them, which they do very effectually, even taking a special liking, it is said, to that which has passed the cattle undigested.

Thus the soil is fertilized, not only by the stalks trodden into it, but by the droppings of both cattle and hogs, and becomes permanent corn ground, while this system continues.

A Rush County Indianian states that after a field of corn has been gathered by hogs, if it is broken up for wheat, it always brings an extraordinary crop.

(*b*), *Feeding domestic animals and poultry* on Indian corn is very extensively practiced. It is fed in the young stalk, in the ear, and in fodder from the ripened plant; and in fodder from the corn sown or planted so thick, that little or none of it ripens. Young growing corn, as many a farmer knows by sad experience, is a great temptation to horned cattle. This fact goes far to justify the practice of soiling, of late so common in the East; especially when the ear begins to form. On some farms nearly all the feeding is done in this way. There being one strong fence around the whole farm, and one round the ample cattle yard, the usual inside fences are saved. The corn is cut green, and carried to them.

Josiah Quincy of Boston, was one of the first in this country, who made the plan a success.

But before giving the views of distinguished farmers on this subject, we will gather from the U. S. Reports a few facts as to the digestive organs and processes of the several domestic animals. As horses and oxen in active service require concentrated food to repair the waste of their mus-

cles, there seems no reason why soiling as a complete system, should apply to them. The horse has but one stomach, and that a small one, but he has very large intestines, and the rapid and continued action of his digestive powers makes him hot blooded, and he can work on a full stomach better than the ox. In the pasture he is continually feeding, and very choice, taking in a little at a time. His molar teeth are less cutting than those of the ox, but are formed for grinding, the lower jaw teeth being narrower than those of the upper, so as to move from side to side; thus triturating the grain. The four stomachs of the ox are very much fitter for digesting coarse provender, but that digestion is more exhausting to his energies, and when he pulls hard, he is entitled to grain as well as fodder. If the cows four stomachs are loaded with coarse food, difficult of digestion, the energy spent in reducing it will be so much lost to the milk. Green food, more than dry, resembles cooked food. In the full grown ox or sheep, the first stomach is most capacious, and the food after passing through the others is returned to the first to be further reduced during rumination. The esophagus which conveys food to the first stomach, is supplied near its lower end with muscles for that purpose. But the fourth stomach is largest in the young calf or lamb, because the milk, its main food, only needs one stomach to change it into chyle. If the cow is worked like the ox, as in some parts of Germany, she will require similar food. If she is kept for her milk, the food must be such as to make it flow; something bulky, nutritive, and easily digestible, as the green cornstalk when the ear is beginning to form. If soiling is well adapted to the feeding of domestic animals not kept for active service, it is especially a dairyman's resource. It is also better suited for Eastern or suburban dairying than for that of broad acres of cheap land and high labor. The subject has been thoroughly discussed in Eastern journals,

and at meetings of Dairymen's associations; the chief objection being the supposed watery character of food used in soiling, and the want of green chlorophyll in the plant, resulting from shutting out the sun by too thick sowing.

Joseph Harris, in an address before the Dairyman's Association at Utica, N. Y., in 1871, said the question was whether the corn was succulent, easily digested, sweet and nutritious. Before coming to ear, it would not be sufficiently concentrated. Take away one third of the water, and one third of the woody fiber, and the remainder would be of much greater value than the whole. The water could be easily got rid of, and the excess of bulk over the desired standard could be reduced by the addition of sufficient corn meal. The President of the same association reported its decision, after a full discussion, bringing into view a great number of trials by practical men, that green corn was a valuable crop as summer food for cows, and useful, whatever plan was taken for raising it; its additional advantages being, that the same ground could be used for a series of years; its taking less manure to keep up needed fertility, than to prepare new ground; and its enabling one to put the crop on land conveniently situated. The dense growth of corn keeps it clear of weeds, and leaves the ground ready for a new crop. Most useful to farmers in New York, if fed to cows, in August or September, when the pastures are short. The cows then put up and fed with corn fodder, would enjoy the change from the heat and exhaustion of summer, and gain new vigor. Meanwhile the cooler nights and increasing moisture would renew the pastures for their fall feeding, and the ruinous fall pasturing of meadows would be avoided.

Dr. Salisbury's analysis of the corn plant at different stages of growth may help to show the proper time of cutting the green crop. He found that on June 3d., fifteen days after planting, the stalk had

Of water in 100 parts, . .	89.62 parts, ;	of dry matter,	10.374	parts.
July 5th., the stalk had water	90.518 "	"	9.482	"
July 26 " "	82.33 "	"	17.66	"
July 12 the root had water	81.026 "	"	18.974	"

As late as the time of tasseling, the water in different parts of the maize plant was : in the leaves 86.78, sheaths 91.48, stalks 95.03, husks 89.08. This analysis of the plant just before the formation of the ear, gave in 100 parts, sugar and extract 35, matter extracted from fiber by solution of potash 12, dextrine and gum 6.04, albumen and caseine 7 96, woody fiber 39; calculated without water. (U. S. Agricultural Report, 1870.)

The Dr's. conclusion as to its value as fodder was : "the plant during tasseling, owing to the large percentage of sugar and extract, with the respectable quantity of albuminous matter and dextrine, which the stalk, leaves and sheaths contain, must afford a very palatable as well as nutritious fodder." The sweet corn seems more prized for soiling than other varieties.

The few cases reported of the failure of green corn fodder as food for milch cows, were probably due to planting so thickly as to keep out the sun and air. One farmer who tried broad-cast sowing, found it better to plant in rows three feet apart, and in hills one foot apart in the rows, dropping three or four kernels in the hill.

The green, juicy state of the stalks at the time of blossoming is supposed to indicate the proper time for cutting, in order to make more and better milk. Farmers in Massachusetts and Michigan have added their testimony to that of New Yorkers as to its value. One dairyman in June 1868 sowed an acre in drills and began cutting on July 1st. for twenty-six cows daily. During September rains he omitted the corn fodder for some days, when the milk fell off 52lbs. per day. After four days he fed the corn fodder, and the cattle regained their yield.

Fodder in a dry state is of two kinds. First, that sown expressly for the stalks and leaves; second, that which remains after the ear is husked out of the ripened plant. The first, from proper seed, and properly grown, is an excellent winter resource for the farmer who adopts the system of soiling. Its excellence for milch cows has been long established, and it is relished by other cattle, horses and sheep. It is the corn hay, having distributed through it the greater part of the nutriment that would have gone into the grain, had its conditions of planting admitted of earing. When this crop, from the best seed, has been well managed, and the season has been favorable, it is fully equal to the best hay, and a much larger product is obtained from an acre. Including the imperfectly grown crops, the statements show that its proportion of value per ton, as compared with good hay, is as one half to one, with a much larger product. This will appear from the facts to be shown in discussing the methods of culture and curing.

Cattle have a preference for sweet corn, but flint and other kinds are sown; some maintaining that the larger sorts planted thickly, produce butts more easily masticated. But the habit of tall growing seems unfavorable for the free admission of sun and air. Probably the Northern seed produces the best crop at the North, though the Southern and Western, if not too slow in growing, may produce a more bulky one. Of course very much depends on the variety.

This fodder is not only of great service in the winter, but in those sections, as in some parts of the South, where grass, at least in the form of hay, is not one of the staples, it is of the greatest advantage as fall feed. It is considered one of the most profitable crops. It may be fed out of the stack like other hay, or cut fine and mixed with corn meal or other ground grains, or chopped vegetables, or it may be compressed, or steamed, and fed in suitable troughs. Steam-

ing is one of the latest and probably one of the best methods, but it is less necessary for this than for the fodder of the corn grain crop. It is a very healthy and nourishing, as well as palatable food for domestic animals.

To show the nature of some of the speculations of ingenious writers on the effect of these fodders, we give the substance of some portions of an article in U. S. P. O. 1847.

Those proximate constituents of plants containing nitrogen are the best food for animals, next those containing carbon, last those containing mineral matters. All the usual fodder substances for cattle contain all three, but in very different proportions. Their vitality takes up only the substances adapted to their species. The power of selection in the same species works according to rule. When the functions of the plant are undisturbed, it always produces the same quality, but not always the same proportionate quantity of the elements peculiar to the kind and species. The proportionate quantity may depend on a multitude of modifications not sufficiently known.

The capacity for nutrition among the proximate elements varies essentially, and the nutritive powers among themselves and with respect to each other have not yet been estimated by any sure method. The nitrogen of the vegetable constituents produces, by assimilation, only combinations of products containing nitrogen; carbon, only those containing carbon; mineral ones, only those containing minerals. Now he who wishes to fatten, stores up what carbon will form fat, and must provide also the nitrogen required to form the flesh to hold the fat; and the material for this must be in the fodder. For his hard working oxen he must look out for fodder containing nitrogen in the solid form. Certain foods agree or disagree, as a peculiarity, in respect to nutritiousness or power of assimilation, say with horned cattle, and have a different value for horses. To know the constituents of a

given fodder stuff is especially important with respect to the object in view. For the nutriment and power of being assimilated, of a fodder containing much carbon and little nitrogen, may be greatly increased by adding one containing more nitrogen, because the different parts intended to be formed in animals by fodder, can only be formed, when the simple constituents absolutely required for their formation exist in the fodder in form and quantity. In consequence of the insufficient form or quantity of a single indespensable constituent in fodder, all the other elements found in the fodder, which might be otherwise employed in the formation of animal substances, are cast out as useless by the excrements. There are different degrees of capacity of assimilation in animals, according to the standard of different species, and also in reference to *individual* power of appropriation; but in no case is there capacity to appropriate all the nutritious substances in a fodder, though they may accord ever so closely with the objects in view, in reference to their separate elements. For in that case the manure would be worthless. Also if any one so combines fodder stuffs, that in respect to the constituent parts, as well as in regard to the form and quantity, they bear the best proportion to the elements of that which is to be produced in the way of assimilation, he can also attain in the object in view, the best increase corresponding to the particular capacity of appropriation possessed by the animal. * * * *

Their form also, their volume, and the preparation with which nutritious substances are given to animals, exercise an influence on their greater or less nutritiousness. The raw, solid form excites more the organs of digestion, than the fluid or prepared, and is on the contrary less easily assimilated. The raw, solid form is much better adapted to the endurance of labor; the fluid, prepared form to increased production of flesh, fat or milk. Food stuffs little nutritive, in large vol-

ume, may, with suitable preparation, be fed out mixed with those which are corresponding, but very nutritious—if food which increases the product is desired for them. The nutritiousness of grain is increased by bruising, fermentation, baking into bread, and cooking; that of raw stuffs by steaming, bruising and self-heating; that of turnips and cabbages by pickling. All substances gain by saturation or mixture with salt. On the whole it appears that no definite and correct rules can be given in all circumstances; consequently the ascertaining the nutritious constituents by analyses, can the less furnish a sure point of support, as analyses give results greatly varying from each other; and the analyses into the remoter or simple elements do not prove that the substances, to be regarded as nutritious, also exist in a form capable of assimilation in fodder stuffs; for we may consider almost all plants which contain nitre as nutritious, because this substance contains nitrogen. The practical use of analysis is in its accurate arithmetical application to the attainment of definitely proposed results.

The above is in the German style of abstract speculation, but contains some practical suggestions worthy of special notice.

One of the above expressions might be excepted to; that almost all plants which contain nitre are nutritious because nitre contains nitrogen. If we are to believe Prof. Liebig, who has done quite as much as any other man in raising the reputation of the nitrogenized elements as sources of nutrition, it is not the fact that a substance contains nitrogen, that makes it technically nutritious, but its nitrogen being in that proportion to carbon, oxygen and hydrogen, which is found in albumen, fibrine and caseine. The writer of the above himself refers to the form, as well as the substance as being required to be true, in order to complete the nutritiousness of any article of food. In regard to analyses; if they

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do vary, and if they do not furnish an absolute *sure* ground of support for agricultural calculations, they are no worse off than great numbers of bases of calculation and action in scientific matters, as well as in affairs of every day life. No child would ever learn to walk, if he would in all cases, before setting down his foot, calculate whether it would touch an absolutely *sure* ground of support. Analyses may be very useful as *aids* to agricultural enquirers, without being stepping stones to reach the most bountiful crops, or reap the largest profits. Geometry was a science more than two thousand years ago, and if the circle, the measurements of which occupy so large a place in the world's affairs, has had any other squaring than that of approximations, it must have been a very recent achievement. Chemistry was hardly a science one hundred years ago, and what a revolution it has made in the progress of the arts! The aids it has furnished through analyses, have been among its greatest triumphs.

One great advantage of the maize plant is that it may be grown successfully for the fodder where the climate will not admit of the grain being a sure crop, as in some parts of Canada and Northern Germany. In some districts where the ripening is merely uncertain, the planting may be for the grain, and if the season proves unfavorable, the cutting up may be for the fodder only. In this way perhaps larger varieties may be gradually acclimated further North.

Maize grown for the fodder is a large item in the agriculture of Cuba.

Fodder from the regular grain crop is a very important product. It is of two kinds—First, what is cut or stripped off from the plant in the act of topping, the ear being left on the lower part of the stalk to ripen; second, the whole stalk cut near the ground, and generally cured in the shock with the ear on it, which is husked out. Much has been written as to the respective advantages of these two methods, which will

be considered hereinafter. The second is the younger method, and has been gaining on the first for a great many years, and since the introduction of machines for cutting up corn, is probably destined to supersede it almost entirely, for general cropping. It was formerly supposed that the quality of the tops and leaves was very much better when removed at that stage which would admit of the ear ripening on the remnant of the stalk left standing. That would be true enough if the fodder was mainly considered, but very doubtful if the weight of the grain and its complete ripeness were the main points. According to the first method, the tops were the best fodder at the North, and the leaves at the South. Some eastern men who have practiced this method of late, have contrived to utilize the butts, after the final harvest of the grain, by salting &c., mixing them in this state with more nutritious kinds of feed, such as sheaf oats. Dr. Nichols, near Boston, tried this and found that only a small portion of the butts was rejected by the cattle to which he fed them. He found considerable nutriment in them; the only difficulty being their solidity; but steaming reduced this so much that the entire stalk was eaten with avidity. It might be very different with the butts of the tall, heavy stalks of the South.

The time of topping is an important condition of the usefulness of this kind of fodder. Mr. Evans, author of Agriculture in Canada, gives as the rule to be followed,—when on stripping the husks open a little at the top of the ears, the grain is found to be hard, but not hard enough to grind, as when dry, but hard enough to resist the strong pressure of the thumb nail; when the farina has quitted the tassel, which is dead and dry; and when the ends of the silk are perfectly dead, appearing withered and brown. When these signs appear, he maintains that the tops and blades have performed their office, and the sooner taken away the better, because

afterwards they do no good, and only serve to retard the ripening of the ears, by excluding in part the sun and wind. But probably in most maize latitudes, this would only hold t ue in part. The tops and leaves were laid in bunches or bundles, in the intervals to dry; and when cured, carried away and stacked, or set up or mowed in the barn for the cattle. In the United States they were considered nearly or quite equal to hay, but Mr. Evans thought they came far short of that in Canada.

The time for cutting off the tops mentioned in the Scotch Rural Encyclopedia, is substantially the same as in Evans, and includes the indications referred to by correspondents of U. S. P. O. from latitude 46° to 39° in 1851 except one—when corn is in milk. The same work says they are of more or less value according to the weather while curing. Cobbett's statement that weight for weight and weather for weather, they will yield more nutriment for cattle than hay, is denied by Wilson's Cyclopedia which says that though used in France and the southern parts of Europe as fodder, they are never found equal to English hay, and are seldom or never given to horses. They are however in the United States.

As to the value of fodder from maize as compared with good hay, very much depends on the manner in which the former is saved. For several years subsequent to 1849 the Agricultural Department of the Patent Office of the United States obtained from its correspondents in different sections much statistical matter in regard to maize fodder. It was highly prized in most quarters. Mr. Temple Cutler, of Hamilton Mass., in 1849–50 described his method, as making the upper half of corn-stalks, including the leaves, equal to timothy or other hay. He cut and got them in the same day, in fair weather; giving them only a little time to wilt in the sun. In the barn, he placed them on poles in good ventilation,

when they kept perfectly sweet, being of a green color. Cattle ate them with great avidity, leaving not a stalk behind. Cows gave more milk, when fed on these, than on the best clover hay, and he was confident they contained more fattening properties. By careful and accurate experiments, weighing the top stalks, he ascertained that an acre producing 45 bushels of corn would yield 2,000 lbs. of dry stalks, cut above the ears The lower part of the stalks would weigh still more, cut and cured in a similar way.

"The proper stage for cutting is when the seeds begin to form, for then the organized elements of the kernels are diffused throughout the whole plant." * * All forage plants should be cured in the shade as far as practicable.

A. W. Dodge, of Hamilton Mass., says the tops and blades well cured, are considered of equal value, ton for ton, with English hay. Two others of the same State say : one, that the shuck compared with the blade, is about one to two; the other, that the value of shucks and blades for stock feeding is one-third that of good hay. Mr. Marsh, of New Hampshire, reckons them at one half. From Xenia Ohio, the shuck was reported at one-third the value of the blade, and the blade well saved, about equal to second rate hay. In Wayne Co., N. Y., a ton of stalks grown for fodder, was more valuable for cows than a ton of hay, being richer, and greatly preferred by them.

From Ashland, Ohio, report was that shuck and blades, weight for weight, were worth as much or more than the best of hay for cattle. From Portland, Ind., that the shucks were very valuable for cattle and horses; from Lincoln Co., Ky, that there was more nutrition in the shucks than the blade, and both valuable for all kinds of stock, especially cattle and sheep. From Montgomery Co., Maryland, that shucks were something more nutritious than good wheat straw for cattle. From Cumberland and Buckingham Counties, Virginia, that

the best corn blades were superior to shucks or hay, or any other long fodder. From the latter it is added that corn shucks, when packed away sufficiently moist to produce a little red mildew, and sprinkled over in packing with a sack of salt to the shucks from 100 bbls. of corn, were very valuable, and when passed through the cutting-box, wet, and mixed with corn-meal or ground oats, they were little inferior to the blades. If the blades are saved and stacked in the field, the shucks quite equal them in nutrition. From Amherst Co., Va., that the blade was equal in value to hay of any kind; the shuck was too coarse for horses, but eaten freely by cows. From Halifax, North Carolina, that the shuck was greatly preferred to the blade, but was more difficult to save in good order; neither shuck nor blade, weight for weight, would compare with good hay. From Edwards, Mississippi, that the blade was preferred to the shuck, and good hay to both. From Washington, Miss., that the shuck was richer and stronger food than the blade, which was chaffy, at best, gathered from the stalks that had matured grain, and was the most costly fodder fed in any country. It cost eight or ten per cent of the grain, in weight and value, by being stripped before the grain was ripe. The cotton crop could not be thoroughly worked, for the fodder pulling. A hand could not pull, bundle and stack more than three or four hundred lbs. per day, during which his health suffered more than at any other work. Blades were equal, pound for pound, to timothy hay as received there in bales. From Memphis, Tennessee, it was reported that the blade was the best long food for horses, exceeding in price the best Northern hay; the average price 70 cts. per cwt.; the shuck fed to cows and young mules. From Licking Co., Ohio, that the shuck, if used immediately after husking, was worth more, pound for pound, than the blade, and both together, deducting the stalk, when well pressed, worth for horned cattle

more than the best of hay, weight for weight. From Clark Co., Ohio, that sheep if they have plenty, will often refuse the husk entirely, while cattle will eat the husk first and then the blade. Same weight of well saved blades better for young stock and horses than average hay.

In the statements of correspondents for 1853 in U. S. P. O. Report, out of some dozen who gave the mode of harvesting, three topped their corn. One was John Brown sen'r., who introduced the Brown corn; he topped early in September, and harvested about October 9th., raising 104 bushels of shelled corn to the acre. The second preferred it as less laborious.

The following table from U. S. P. O. Reports 1849 and 1850, shows a great diminution in the phosphates, potash and chlorine, and organic acids from July 19th to Oct. 18th (these having gone into the grain mostly,) and a great increase of silica and lime, so necessary to the strength of the stalk. Elements of ash of leaves of maize at different stages.

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	July 19.	Aug 2.	Aug 23.	Aug 30.	Oct 18.
Carbonic Acid	5.40	2 850	0.65	3.50	4.050
Silica	13 50	19.850	34.90	36.27	58.650
Sulphuric Acid	2 16	1.995	4.92	5 84.	4.881
Phosphates	21.60	16.250	17.00	13 50	5.850
Lime	0 69	4.035	2 00	3.38	4.510
Magnesia	0.37	2.980	1.59	2.30	0.865
Potash	9 98	11.675	10.85	9.15	7 333
Soda	34 39	29.590	21.23	22·13	8.520
Chlorine	4.55	6.020	3 06	1.63	2.664
Organic Acid	5.50	2 400	3.38	2 05	2.200
Totals	98.14	97.750	99.58	99.75	99.523

The Fodder from the general crop, after the grain is removed, like other fodder, is rich or poor according to the time of cutting and care in saving. Different indications are relied on for the best time of cutting up at the ground; a certain dryness of the lower leaves, a certain degree of hardness of

the grain, a certain whitening or browning of the green husks; the finding, on careful examination, no ear but what is too old for boiling, &c. &c. The manner of curing will be described hereafter. If put up in too large shocks, it is apt in moist situations to mould; if in too small shocks (unless re-shocked after a few days, or removed to the ricks) to become weather beaten and to lose its flavor. In husking, the shucks are usually left on the stalk. This fodder is very much prized, and is generally estimated at one half the value of good hay. Its virtues are often improved by chopping, scalding, compressing or steaming, and mixing with meal, bran or other grain. The value has often been reckoned at one-third that of the grain.

The simplest way of feeding is to draw the corn stalks before husked to the feed lots, often portions of a pasture temporarily fenced in, and to spread it over the ground; first turning in the fatting cattle, which are soon turned into another lot, followed by stock cattle, and these by hogs. After a general husking, fodder may be fed out every day, especially during winter, either spread over the pasture lots, or the cattle-yard sloped circularly towards the centre, where the liquid manure and falling water collect and act as a solvent for that which is rejected by the cattle; or it may pass through the cutting-box and be thrown into the troughs to be wet, salted or mixed, for the cattle or horses in the stalls. Some have protested against cutting too short, as subjecting the gums of the cattle to injury from the hard and sharp material of the butts, which might be prevented by making the length of the pieces greater than the diameter. Some cut half an inch long. To do this economically, a great number of labor saving machines have been patented. They are too numerous for any general description.

Some feeders after cutting fine the fodder for horses and neat cattle, scald it, so that it almost equals the green state,

especially in producing a flow of milk. Mixing the cut fodder with shorts, meal or bran, adds to its feeding value twenty-five or thirty per cent.

An ox is said to eat two per cent of his live weight.

A farmer, (see U. S. Agricultural Report 1869,) recommends, from personal experience, the following apparatus for steaming. A large box, made steam tight, is placed within a larger box, with some non-conducting material, such as sawdust, packed between, at least twelve inches thick. The food to be cooked being placed in the steam box, hot water is turned in, and the apparatus covered lightly with woolen rags to confine the heat. Among the results claimed for cooked or steamed food for domestic animals are—it makes mouldy cornstalks &c., perfectly sweet and palatable for animals.

In U. S. P. O. Report 1865, E. W. Stewart, of New York, says when keeping a large stock, there were often bought for steaming, stacks of fodder which would have been utterly worthless for feeding in the ordinary way, and no difference was detected after steaming in the smell, or relish with which it was eaten. The odor of bran or corn-meal mixed with the fodder is diffused through the whole mass. It softens the toughest fiber of dry cornstalks, rendering them almost like green succulent food, &c. It enables the farmer to turn almost everything raised, into food for his stock, *without lessening the value of the manure.* The manure from steamed food decomposes more readily; is always ready for use. It cures incipient heaves in horses; those having a cough for several months at pasture, have been cured in two weeks on steamed food. It has a remarkable effect on horses in cases of sudden colds and in constipation. Those fed on it are much less liable to disease, and in this respect, it seems to have all the good qualities of grass. It brightens the appearance of an animal, makes him more contented, gives him when working, the necessary time to eat, and enables the

farmer to fatten in one-third less time. It saves one-third of the food; two bushels of cut and cooked hay satisfying cows as well as three bushels uncooked.

The machinery for cooking corn fodder was thus described. "U. S. Agricultural Report 1865, pp 403. A portable steam engine of five horse power provided, the animals, steam box, food &c., arranged as follows: The stables are in the lower story, on each side of a feeding floor, ten feet wide. It would be more convenient to have room around each tier of animals to pass a cart or wagon to carry off the manure, than to throw it out at the side. A wooden track is laid in the center of the feeding floor, on which to run the steam boxes. Two, holding one hundred bushels each, should be provided for one hundred cattle. One would run under the upper floor to be filled and steamed, and then be moved away for use; while the other could be run to the spot, filled and steamed. On the upper floor the straw cutter would be placed, provided with a feeding apron to feed itself, with two bins overhead, one for cut hay or straw, the other for meal or bran. Elevators to carry up the cut feed from the cutter to the feed bin, as fast as cut, would be necessary—also a water pipe connected with an elevated reservoir, to furnish water to moisten the feed. A tank might be placed overhead. An upright revolving shaft will be set in the center, provided with six arms just long enough to turn inside. This shaft will pass through a like cross-bar on the top, and extend above enough to receive a pulley of the proper size to revolve it 600 times per minute. A spout extends from an elevated feed bin to the top of this cylinder, with a slide to open or shut it. A spout also extends from the meal or bran bin, so as to communicate in the same way with the cylinder, and a water pipe, with a stop-cock and moveable cover, is placed on the top of the cylinder. A belt runs from the engine to the pulley on the top of this shaft. When ready

to fill the steam box, the shaft is set in motion; the spout for cut feed operates so as to discharge a definite quantity, and the spout for meal, so as to discharge the proportion desired; and the water is let in, 20 gallons for 50 bushels of feed.

The feed, meal and water, in passing through the cylinder, will come in contact with these swift moving arms, and be thoroughly mixed, and fall into the steam box, ready for steaming. The food should be pressed into the steam box as more will be steamed, and better. One expert man may cut and steam feed for one hundred head of cattle, and two men could easily care for two hundred. Thus with proper system and machinery, the expense of cutting and steaming for a large stock, will be little more than the ordinary way of feeding. This steam engine may be used to grind the grain, cut and steam the food, and do all the work requiring stationary power on the farm. The engine should be placed as near the steam box and straw cutter as it can be safely; with a double spark extinguisher over the chimney to prevent fire.

Wetting the feed, as well as steaming, is suitably provided for in the above arrangement. The want of sufficient wetting is said to have been the great mistake in the early experiments in steaming fodder in America and England.

Fed in the common way, without housing, fodder is much better for early than late winter feeding. Kept in barns, it may keep good for three years; cut five or six inches long, saves waste. A Michigan correspondent of Moore's Rural New Yorker, for November, 1873, advises for winter feed the mixing of cut fodder, one bushel, with two quarts of meal ground from corn, oats and wheat screenings, as causing a greater flow of milk than clear corn-meal. H. Mosely. a butter maker, was said by the Springfield Mass. Republican, to feed corn-stalks twice in the morning before milking, afterwards hay, cut feed, corn fodder, oats and hay wet with warm water and mixed with corn and rye meal.

The corn fodder has been frequently said to pay for harvesting the grain crop. Its money value has been variously stated in different years and at different places. In 1853, in Wayne Co., Michigan, where the grain was 50 cts. per bushel, thirty-five bushels being the average crop, the stalks were worth \$3.00 per acre. Near Lake Village, New Hampshire, corn was \$1.00 per bushel, and in a crop of 104 bushels to the acre, four tons of husks and stalks were valued at \$8.00. In Seneca Co., N. Y., in a crop of 50 bushels per acre at 56 cts., the acre of corn-stalks was worth \$4.00.—In other years, the stalks were reckoned at \$5.00 per ton for food and \$2.00 for manure; sometimes at \$15.00 per ton.

A farmer in 1851 found sown corn fodder better than the best of hay for sheep, and the product per acre three times that of the best meadow land; he had kept from two to four hundred head on it almost exclusively; the fodder from 1½ to two acres sufficient to winter one hundred head of sheep without any grain, except for ewes, through the month of March.

As to the feeding qualities of corn generally, the testimony is very ample and positive. From Delaware Co., Pennsylvania, it was stated that the most economical and profitable extra feed for working cattle, horses, beef cattle, hogs, dairy stock, poultry (taking into view the comparative certainty of obtaining a crop, against all seasons and accidents,) was corn. Fifty per cent of the entire profits of our agriculture, exclusive of dairying, came, directly or indirectly, from corn alone.

In the ear, soft corn, or that not perfectly ripe, including nubbins, so called, are fed to cattle and hogs whole; the cattle munching cob and all. They do not contain as much nutriment, but they are more digestible than corn perfectly ripe Soft corn is said to suit horses. Ripe corn in the ear or shelled is considered by most farmers, who can get good prices for their grain, unprofitable, fed dry to full grown

horned cattle. It is otherwise with young cattle and sheep. An Ohio farmer, writing to one of our agricultural journals on wintering calves, advises giving them good shelter, shelled corn and plenty of good clover hay, or corn fodder, and asserts that corn meal is apt to make them scour; the feeding of corn to be light at first and gradually increased. Wilson's Rural Cyclopedia says a feed of whole corn reveals the comparative youth or age of horses, whose grinders cannot be seen by an intelligent purchaser. If his grinders are old and worn, he will slobber the grain out of his mouth; if young, he will grind it soundly and vigorously with a noise that cannot be mistaken.

According to Dr. Salisbury (see U. S. P. O. Report, 1861,) the maize grain has in 100 parts,

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	Aug 30.	Sept 13.	Oct 18		Aug 30.	Sept 13.	Oct 18.
Sugar and extract	3 67	5.10	13 32	Matter from fiber...	1.03	1.53	5.99
Starch	1.04	9.75	56.30	Albumen........	0.21	0.84	4 29
Fibre	....	2.43	0.89	Caseine................	0.08	0.04	0.08
Oil.......................	....	....	4.60	Dextrine...............	0.64	0.66	3.[illegible]6
Gluten..............	1.42	....	3.68	Water..................	90.80	78.75	8.45

"The analyses of the cob, shows that these elements pass from the stalk to it, and from it to the grain." The great increase of sugar and starch in October shows that their development takes place late; that of oil especially. A want of sap due to drought, checks these operations. Nearly five-sixths of the starch, more than half the sugar, nearly all the oil, nearly two-thirds of the gluten, and four-fifths of the albumen and dextrine are developed during the last thirty-five days of the period indicated by the above dates.

Little undigested corn fed whole is said to pass horses and sheep. An Ohio farmer preferred feeding in the ear if the horse gets the lampers; if corn ready shelled, they grow on him; if fed in the ear, he will eat them off. It does better

feeding corn whole to hard working horses and oxen. After an animal has been freely fed on ground or cooked food for a considerable time and the fatting is nearly complete, it may be best to wind up with good hard corn, and this is often done. But the propriety of feeding corn dry and whole must depend largely on the vigor of the animal and the state of his teeth, as the general rule is that all unbroken seeds pass the animal undigested. But if the digestive powers are very much stimulated by severe exercise, what then? The great majority of late writers on the subject, whatever the general practice may be, favor the softening or breaking of the grain, previous to feeding. It is very easy keeping corn to soak for feeding, when grinding is inconvenient. Many farmers, when there is much feeding to do, always keep a barrel or hogshead of soaked ears on hand. This saves the time and expense of steaming or grinding, as well as the toll or freight.

Of five farmers of long experience in different parts of Washington and Meigs Counties, Ohio, one soaked more or less for cattle, horses and hogs, twenty-four hours in spring, and twelve hours in summer; on corn soaked in the ear, he raised as good a lot of hogs, as he ever did by other methods. Another said that soaking for cattle would do for a while, but they would whet their teeth on it, till they would not eat it, he soaked for hogs, shelled; but preferred grinding and cooking; and there was a gain of one-fourth by letting it sour in summer. A third found it best steaming cob and all for cattle and hogs, and soaking in a barrel, with two quarts of salt on top for horses. A fourth found a gain of one quarter in grinding and cooking for cows, but fed shelled unground to sheep, and boiled in the ear to horses and hogs. A fifth fed the small ears whole in autumn to cattle and horses, and ground and cooked the balance for cattle, and ground and wet the balance, (except in winter, when he soaked it) for

horses; fed bran and chop stuff to sheep, and corn in the ear to hogs. The cobs of green corn used for human food, both before and after boiling, are eaten with great relish by hogs.

Many farmers shell their corn and cook it whole. One method is to fill a potash kettle half full of shelled corn, then fill to the brim with water and boil the water away; leaving the vessel full of boiled corn. It is much more rapidly cooked when broken. This has been recommended by some for hog feeding, as adding considerable to the nutriment of the grain. But it may be a question whether some of the nutritious qualities of the grain may not be dissipated by long boiling. The simplest way of breaking the grain is crushing it. Many prefer this to grinding, for horses. In 1870 it was stated on the authority of an English Journal that feeding horses on crushed maize had become very common of late in England. Corn and cob crushers were in fashion many years ago.

Allusion has already been made, in connection with the analyses of the cobs, to the different views of farmers as to their nutritive qualities. It might be added that when mixed in a crushed state, with other feed, they help out the manure. As fuel, they are much esteemed for smoke-houses. At a discussion in one of the Farmer's Associations which are becoming so interesting in some of the older States, Dr. Sylvester said he had experimented on cobs ground with corn, and found they produced good milk. He estimated the cobs, when ground with corn at 15 to 20 cts. per bushel. Prof. Whitney thought the preparation of the cobs cost more than the good they did. When the ears were boiled whole, the cobs might help eke out the scanty forage of a hard spring.

Next as to grinding the grain, it is generally estimated that for horses and cattle, twenty to thirty per cent is gained in feeding qualities, or added to the value of the corn. For horses, coarse grinding is said to be the best. For oxen

and cows, perhaps the greatest gain is in sprinkling the meal over cut fodder. This with a little salt makes the coarse provender very palatable. Fed to milch cows in their slop, it is a very effectual milk compeller. For hogs it is a considerable gain on the whole corn, but cooking the meal makes it go much further. The grinding, however, will hardly pay, if labor is high, and corn low, and the farmer must pay a heavy toll for grinding, or lose much time or labor in getting it ground. Good judges say it pays if the toll is only one eighth, and the mill is near by. If the feeder has a mill of his own at his farm, the case is very much altered, that is, if it is of sufficient power to give employment to a boy. The calculation is easily made, when the farmer knows clearly the value of his time and the expense of the grinding. In feeding coarse fodder, hay or straw, the meal has a special value in making them more palatable. Grinding also makes cooking for hogs easy. The favorable effect of the two operations in hog feeding has been variously estimated at forty to one hundred per cent. One farmer mentions as a simple contrivance of his, for breaking the corn in a small way, the fastening of a plane bitt in a board, so as to act like a plane in taking shavings off an ear of corn.

A distinguished Vermont drover, at the Farmer's club, declared strongly in favor of corn-meal for fattening stock generally; he said that the farmers did not feed heavy enough, and that of twelve quarts fed, the last four did twice as much for fatting as the first four.

In the earlier volumes of the U. S. P. O. and Agricultural Reports, is placed on record quite a range of testimony as to the different methods of feeding maize to the different domestic animals, which was brought out by the efforts of the Department to ascertain the different opinions and practice on the subject prevalent in the various sections of the United States. That embodied in the Report for 1849–50, is strong

in favor of grinding for cattle, and grinding and cooking for hogs; less favorable to grinding for horses and perhaps still less for sheep, because they were thought to masticate the grain more thoroughly. There was a greater unanimity in the witnesses to this effect from the Atlantic than from the Western States. A Southern planter gave his opinion that if the feeding was to be done by plantation negroes, corn were best fed in the ear. Some recommended boiling whole, others crushing the grain and cob together; two giving it as their experience, that the ground cob added one-third to the nutriment of the grain. One expressed a doubt whether the fat from cooked corn was as solid as that from whole grain raw. Corn-meal was said to be best for beef cattle. The range of estimates of increase from grinding, or crushing and cooking was not far from that already stated. The advantage of cooking was illustrated every day at the distilleries, where after distilling, the refuse corn was considered equal to the raw grain for feeding. An Illinoian gave his opinion that grinding and cooking increased the nutriment, but would not pay in feeding beef cattle; it might in hog feeding. As to mixtures of feed, horses had been seen looking very fat and sleek after being fed on cracked corn and oats moistened with salt water; and corn ground with rye was good horse feed.

There were fewer statements on the subject in the U. S. P. O. Report for 1853. Two, from Illinois and Pennsylvania, favored corn and cob meal, the latter estimating the loss in feeding whole to cattle or sheep at one-fourth. But a New Yorker said he had known corn ground with the cob to inflame the stomachs of horses and cattle eating it, so as to prove fatal.

Mr. Joseph Sullivant, in the Ohio Agricultural Report for 1869, has a very elaborate article on hog feeding and pork making, in which he states that the "chemical analysis of the corn cob gives six to ten per cent of matter that may be

rendered, by long maceration and boiling, capable of assimilation by the animal. "He thought the nutriment in cob feeding was not paying, but an occasional feed of cob-meal would relieve that instinctive want that induced the hog to eat coal, rotten wood, and even clay and dirt." The experiments of Lawes and Miles had shown that as the hog approached maturity of fatness, the quantity of corn required for making a pound of pork increased, and he thought it would take less food to make 600 lbs. of pork from two animals than from one. His estimate of the number of pounds of pork to be made from one bushel of corn, was, if fed on the ear, 9, as raw meal 12, as boiled corn 13½, and as cooked meal 15.—But sixteen to nineteen pounds of pork were possible, and eighteen to twenty pounds to the bushel were not unfrequent in actual practice. The result of two experiments by Robert Thatcher, a Pennsylvanian, one on five very ordinary pigs, getting $16\frac{8}{10}$ pounds, and the other on five superior Chester pigs, resulting in $17\frac{44}{100}$ lbs. from a bushel of cooked meal, was accounted for by the feeder as due to "very careful feeding, clean and warm bedding, and a tight house."

Prof. Miles of the Michigan Agricultural College, in the course of an experiment in fattening pigs, fed two for twenty weeks on corn meal and in 140 days they gained 205½ lbs. or $98\frac{59}{100}$ lbs. each pig, over the original weight. "In the twenty weeks, 935½ lbs. of meal were consumed, equal to $16\frac{7}{10}$ bushels of corn, and giving a return of $12\frac{3}{10}$ lbs. of pork for each bushel, and requiring 4½ lbs. of meal to make one of pork." They were grade Essex pigs; two weeks old when the first feeding began, which was a mixed diet of milk, meal and a portion of roots, and was continued nine weeks before the twenty weeks on corn-meal commenced. Prof. Miles' deduction from his experiments was that in pork making the best return will be obtained by "liberal feeding during the early stages of growth." The result of experiments by Mr.

Lawes, (of England,) of a similar kind was "that the larger the proportion of nitrogenous compounds in the food, the greater the tendency to increase in *frame* and *flesh*, but that the *maturing* or *ripening* of the animal—in fact its fattening—depends *very much more* on the amount, in the food, of certain digestible *non*-nitrogenous constituents." G. Geddes, of Syracuse, N. Y., is quoted as stating at "Discussions" during the New York State Fair, 1867, that "he had thoroughly proved, years ago, that cooking independent of grinding, at least *doubled* the value of food." G. A. Moore, of Erie Co., N. Y., "had fully satisfied himself that the value of food was *tripled* by cooking." Prof. Mapes, says (in Transactions of American Institute, 1864,) "this experiment often tried, has proved that eighteen or nineteen pounds of cooked corn is equal to fifty pounds of raw corn for hog feed; and Mr. Mason, of New Jersey, found that pork fed with raw grain, cost 12½cts. per lb., and that from cooked corn 4½cts.

It is evident that the breed and condition of the animal fed, the variety of the corn consumed, the climate, the season and the surroundings, as well as the manner of feeding must be taken into view in accounting for the results of different modes of treatment. The mode of feeding, with a view to profit, must often be determined in a great measure by the scale on which the feeder operates. An Indianian in 1869, found the best food for young pigs was corn-bread crumbled in milk or dish water; they gaining a pound a day in weight.

A Delhi correspondent of the Cincinnati Gazette shows the advantage of mixed food used on a large scale by feeding 108 cows at 4 a. m. and 5 p. m. as follows: Into a car box 16 feet long, 3 feet wide and 3 feet deep, two bbls. of meal ground in cob were thrown, then 1 bbl. of middlings and 4 bushels of barley sprouts from malt manufactory. This was shoveled over to mix, then cut corn fodder, or clover hay was added, making the box three-fourths full. Morning food pre-

pared the previous evening, evening food in the morning. This suggests the importance of regularity in feeding. Some farmers recommend feeding the same animal, meal in one trough, and whole corn in another, giving him access to both.

If the assertion is true, as made by one writer that unbroken corn in all cases passes the stomachs whole, of all animals except birds, then the quadruped that eats, if he digests, must grind the grain himself. This would be allowing better molar teeth to young cattle and sheep than to the rest of their fraternity. Indeed the teeth of the animal have considerable to do with the manner of feeding.

Certain general principles on this subject are quoted in U. S Agricultural Report, 1865, substantially as follows: Globules containing meal, flour or starch, whether in grain or roots, are incapable of affording any nourishment as food for animals till broken. The mechanical method of breaking or grinding, is only partially sufficient. The most efficient manner of breaking globules is by heat, fermentation or chemical agency of acids or alkalies. Dextrine, the kernel of each globule, is alone soluble, and therefore alone nutritive. The shells of the globules are reduced to fragments by mechanism or heat. Cooking, if long continued, will burst them, but some mechanical force will do it very much sooner, as any one knows who has tried cooking corn whole and unbroken. The mouse-eaten kernel is softened much sooner than its fellows.

Cooking for the animal saves part of the waste of the tissues and heat producing elements, and makes the digestion more rapid and complete. The added flesh or fat is stored away sooner, and room left for more. The water so necessary to good digestion is cooked into the food, and distends the stomach, and lays the nutritive particles open to the proper organs. The delicate stomachs of swine are certainly good arguments for cooking their food, but their dental ap-

paratus admits of the occasional feeding, at certain stages of development, of whole corn with decided advantage, provided pure water is given with it; and when cheap corn, scant fuel, high labor and other circumstances make it advantageous to the feeder, for the porker to grind and cook his own feed, the delicate stomach refuses to make as ample returns in fat and flesh, or demands more corn for making them. Other viands than cooked meal for this delicate stomach as well as for the stronger stomachs of the cow and sheep, may be more cheaply provided near the manufactories of large cities, where also the carrying and marketing of the product are easier and more certain; and the kitchen, that common friend to the swinish and bovine races, in the case of small pens and barns near by, may diminish considerably the drafts on the corn-crib, by a more thorough preparation of what is taken therefrom.

As to work animals, those farmers who testify that cooking for work animals is not favorable, confirm the theory that exercise stimulates the digestive organs, and that severe labor, in hastening the transformation of the tissues and increasing the animal heat, makes the organs more powerful for assimilation, while it creates the fierce demand for food we call hunger, and causes the nutritive matter to be of more account than the saving of the tissues of the stomach.

Feeding poultry.—Corn is excellent for this purpose, and is much used in the United States, especially for fattening. It is fed to them in all sorts of ways except as raw meal, dry or wet. For young chickens wet meal is dangerous—giving them the gapes.

Wilson in the Rural Cyclopedia says that maize grain is fed whole to large fowls, and bruised for smaller ones, and that these are remarkably well adapted for feeding and fattening all kinds of poultry. All the famous, fat, large livered geese of North-west France and South-east Germany are

fed with whole maize, and all farm-yard hens and barn door turkeys, of Great Britain, would succeed better on a plain diet of maize, than, in the former case, on most special feeding, and in the latter on the filthy, splashy, expensive and most troublesome system of cramming. Cobbett says he killed one pullet not of large breed, out of which he took loose fat weighing ¾ lb. Fattened most perfectly ten turkeys in the same manner. Geese and ducks fatten easier than either of the former, fattened in the same way.

For fresh eggs in winter, plenty of corn is given whole. To very little chickens or young turkeys, some is given in a cracked state, but they soon learn to take it down whole. Sparrows eat it as fast as fowls; hence poultry should be fed close to the door.

Bennett, in a work on fowls, describes certain experiments of a French poulterer in cooking corn for fowls in various ways, which illustrates the profit of so doing. Mush from corn meal is very much relished by hens, and in satisfactory quantities multiplies eggs. Mixed feed for fowls, as well as our other domestic dependants, is fast getting into favor. A change of food works well. The smaller and oily kinds of corn seem specially fitted for chickens. One of these, called *maize a poulet*, has been very much in use in France for this purpose.

Human food.—Indian corn as a bread material, to be manufactured on a large scale, cannot compete with wheat. Not that it is really less nourishing, but because from the comparative coarseness of the meal and the smaller quantity of gluten, it cannot assume the saleable forms of cracker and loaf, which wheat flour takes on so easily. As cakes, warm bread, mush, samp, hominy, hulled, parched and popped corn, and roasting and boiling ears, it is very much relished by a great many, even as a luxury, and in certain quarters as common food; presenting, if anything, a greater variety of

dishes than wheat flour or any other grain can produce. And for these general or occasional purposes its use throughout Christendom, if not throughout its native America is doubtless on the increase. But it will probably never again be so exclusively used as vegetable food as it was by the Mexicans of Cortez' time, or by the North American Indians, or by the slaveholding communities of the Southern United States.

Roasting or boiling ears.—Any one observing the huge piles of green corn ears on the pavement by the city market place in summer and early fall, will realize what an important place this luscious article of food takes at our city tables—especially in *large* cities where corn bread for sale is hardly known.

Any of the common varieties taken at the right stage may be boiled or roasted with some advantage, but the sugar corn is very generally preferred. The requisites are that the saccharine matter shall be well developed, and that the kernels shall have attained their full size, but are still soft and yielding to the finger-nail. Perhaps the best indication of their fitness for boiling is the dryness of the silk at the end of the ear, while the husk outside has lost none of its greenness. It requires some experience however to select surely and readily, ears not too young, nor too hard for healthful and nutritious eating, when boiled. Some cooks shave the grain from the cob with a sharp knife before boiling, as when cooked with beans. Others grate the corn off the cob, and make corn soup. Some break the surface before boiling; others cut the corn off after boiling; but most generally it is brought to the table in the ear, and eaten with a little salt or butter. Corn soup is one of the richest and most wholesome of viands.

The New York Albion, speaking of these ears with their grains that seem bursting with milky juice, says that when placed a sufficient time before the fire, they become little

bags of delicious milk. Americans commonly roast the ears before a clear fire, or on hot embers. Boiled are not so good as roasted ears, yet esteemed very palatable when boiled with fat pork.

The female flowers are gathered by some of the French and Germans before the male flowers have expanded, and are pickled like cucumbers. Young small culms of thickly grown crops are cut from time to time by the Mexicans, and served in desserts in the manner of Asparagus, in order that they may yield their sweet juices to the mouth when chewed.

A German correspondent of a Vienna (Austria) Journal, says the extremely saccharine stalk is eaten raw by many Indians. Reference has already been made to the choice varieties, Sugar, Evergreen, Darling, Canada and New Mexican Black &c. The Adams is a late variety which produces very good boiling ears. The ears of the above sorts are generally small, and in some kinds, shriveled when dry. All these ripen early, some by the 18th of July or earlier.

In Cincinnati the average price per dozen in July 1869 was 10 to 20 cts. per doz.; in July 1872, 15 to 20 cts.; in October 1876, 5 to 15 cts.

Many of the poorer Mexicans are said to subsist entirely on the "unripe ears cooked." Some of the Indians preserve roasting ears for winter by stringing and drying. From the Cincinnati Weekly Gazettes from 1871 to 1873 are extracted the substance of a few recipes for disposing of green corn.

(A.)—Scrapes the corn from the cob with the back of the knife, thus securing the sweetest portion; cooks with milk or cream, boils the cobs with beans, drains the latter when cooked, and mixes with the corn, adding salt and water.

(B.)—Scalds the corn, not enough to harden it, then shaves the grain off the ear, so as to divide it three or four times; scrapes the chits from the cob, being the sweetest part, adds sweet milk with a little water, butter and salt, lets it simmer

for twelve minutes and stirs in evenly, a beaten egg—to be eaten with a very little sugar.

Drying green corn. (C.)—Plucks it before it grows hard, cuts it from the cob without scalding; dries in the sun, or about a stove; soaks a few hours before cooking. Keeps in loose sacks instead of jars, and so prevents mould.

(D.)—After cutting, scrapes the cob with a knife to get all the heart and milk; stirs it in a skillet on a stove till dry as it can be stirred; then salts and peppers and spreads thin, and dries in the sun. Will cook much quicker than when boiled on the cob; makes a good soup for the sick.

(E.)—Packs in a jar or some clean vessel, the corn from well selected roasting ears; first covers with salt ad libitum; then covers the vessel till wanted for use, when it is well washed, and soaked over night; stewed in a little water about half an hour, and seasoned with butter, cream and pepper.

Canning. (F.)—Dissolves 1¼ oz. tartaric acid in a half pint of water; cuts the corn from the cob and when cooked in sufficient water, adds one table-spoonful of the solution to each pint of the corn, and cans immediately, using tin cans. After opening adds a very little soda, four or five hours before using.

(G.)—Cuts the corn from the cob into a kettle, and covers with water; dissolves two oz. tartaric acid in one pint of hot water; adds six table-spoonfuls of liquid to each gallon of corn; then boils five minutes and cans; not pressing the corn tightly, but letting the water stand over it; seals, and keeps in a cool place; on opening, empties into a crock, and washes in a couple of waters, adds half a tea-spoonful of soda and two table-spoonfuls of sugar to one quart of corn; finishes with salt, pepper and butter, and if preferred, a little cream and flour; and then cooks five minutes.

Succotash or Sucatush is a term frequently applied to corn cut from the cob and boiled with beans. It is said to be an

abbreviation or change from *musiquatush*, an ancient Indian dish, in which however (see U. S. P. O. Report 1866, pp 499 to 504) the Indians are said to have boiled fish and venison, and flesh of bears, beaver, moose, otter or raccoon, as well as peas, pumpkins and other vegetables raised among their corn. Corn is toasted by the Apache and other Indians by placing the kernels in a basket with a few live coals, or heated stones, and shaking rapidly; occasionally holding the open basket to the fire.

(*e.*)—*The stalk*, after the ear is pulled, at the right stage for boiling, will go on for a considerable time filling up with sweet juice, and if ground and pressed, might make a tolerable syrup. But when sugar can be obtained at the present average prices, it would not be very profitable making such stalks into syrup, even if enough of them were robbed of their ears. The ancient Mexicans made syrup of the stalks, and the same thing has been done occasionally in the United States.

(*f.*)—Of the ripened grain, *parched* corn is probably the most economical preparation. If the variety used abounds in starch, and contains a reasonable amount of oil, moderate heat causes it to swell and brown over the fire. Very good teeth may manage it whole; but where these are deficient, it is better ground. If first crushed in a mortar, and then ground fine in a coffee mill or small corn mill, it makes a very palatable meal, which, if one's beard is short enough, may be eaten dry; if otherwise, it is better wet, and best of all, wet with sweet milk. This meal of parched corn is said to have been carried in little bags by the Indians in the early years of our colonial history, when going long journeys on foot, being very effective in keeping up the strength of the system. (See U. S. P. O. Report, 1866.) The warriors on a war-path, subsisted on parched corn, which they called "Nokakee." Roger Williams traveled with two hundred

Indians at once, nearly two hundred miles through the woods, every man carrying a little basketful of this at his back, sufficient for three or four days provision. Parched meal is probably the lightest, as well as most economical substitute for bread known, as what water there is in the grain is nearly all evolved in parching. The Mexicans roast the kernels for food. The Western Indians now consume large quantities of parched corn.

(*g*)—*Shelled corn boiled whole* has been recommended by some, but the boiling is a long process, unless something is put into the boiler, to hasten the breaking of the epidermis. It is a question too whether much of the flavor of the kernel is not dissipated in the boiling before it is sufficiently complete for digestion. The larger grained varieties are best suited for this purpose. Eaten with milk or soup, it makes an agreeable and nourishing diet; but perhaps it is not best to swallow the hulls, unless well broken in cooking or in chewing.

(*h.*)—*Hulled* corn is the grain boiled for a while in water in which potash or pearlash is infused, which hastens the removal of the hulls. The oil with this alkali forms a soap. Sometimes a little bag of wood ashes unleached, is substituted for potash in the kettle of corn. When the hulls are fairly loosened, the mass is taken out, and thoroughly washed, and rinsed; the rinsing water carrying away the hulls; the corn then boiled until thoroughly done. The time required for this purpose makes it advisable to cook a huge kettle full at once. Eaten with milk, it is quite palatable; when cold, may be fried, or otherwise warmed up. It is probably a rare dish of late.

(*i.*)—The Indians had their *O-mo-nee.* After they had selected out their seed for the next year from the crop of maize grown, the balance was dried in the husk on stagings over a smouldering fire, then husked, shelled packed in large birch

bark boxes and buried in the ground below the action of frost. *Omonee* was this dried corn cracked in a stone mortar and then boiled. (B. P. Poore on Agriculture, U. S. Agricultural Report, 1866) Our word hominy seems to be derived from this, sometimes spelled hommony. For this the grain is first hulled, and then simply broken, not ground. What is sometimes called yankee corn, including the flinty kinds, would seem most fitted for its manufacture. One of seven premiums given at the Indiana State Fair in 1869, on the best samples of corn, was on hominy corn, the others being on yellow, white and other colored varieties.

The Pueblo and other Indians boil their corn in weak lime water, to remove the hull, and grind it into a soft pulp, of which cakes or bread are made. Hominy requires careful boiling, gentle and long enough continued. It is apt when placed over a heavy fire, to stick to the kettle and burn. It is most palatable, as well as most wholesome, when boiled quite soft.

(*j.*)—*Samp* (the coarser parts of ground corn sifted out, and separated from the bran proper) when thoroughly cooked, is one of the best dishes prepared from maize. Where Indian corn is produced most abundantly, the white is mostly preferred for human food; its flavor being more agreeable, and its appearance more inviting.

(*k.*)—*Grinding and cooking for the table.* Corn-meal in its various preparations, is the chief medium through which this grain reaches the human stomach. Corn *cakes* are the form it has most generally taken. The North American Indians in Capt. Smith's time, after bruising it in a mortar, sifted it through a basket for ash cakes. The Mexican tortillas belong to the past, as well as the present. The shelled corn is softened in water with the aid of lime, then rubbed on a flat stone into a fine mass, and from this is formed into their round cakes, which are baked on a thin *clay plate*, and eaten

hot from the plate in place of bread, the Mexicans preferring the tortilla. A woman spends six hours every day in preparing them, and 312,500 strong, healthy Mexican women are said to be so employed.

H. Carl Heller, in the Vienna Zeitung, writing from Toluca in 1846, says that raw meal is also made into tortillas for the Spaniards.

The Pueblo Indians of New Mexico and Arizona are said by a writer in the U. S. P. O. Report, 1870, to cultivate in the primitive manner the original corn of America, of pink, blue and white colors, and small slender ears. These are pounded in a stone mortar into bluish white meal, and made into a kind of cake, called Tourke bread. A brisk fire is made under a slab of iron, or stone or a flat earthenware plate, supported by stones, resting on the ground, so as to admit the fire. A batter is then made of the meal, into which the women having pressed the fingers of the right hand together, dip and draw them out thickly covered with the batter, which they press evenly on this heated substitute for a pan; leaving a thin coating which quickly curls up; a sign that it is cooked on that side. It is then taken off, and another dip made with the fingers is spread as before, then the upper side of the first cake is laid on top of the new dip; and when the second is ready to turn, the first is already cooked, and the second put through the same process as the first, and so on till a large pile of these wafer like sheets is rolled up—called by the Indians *guaguave*. It has a look like something coarser than blue wrapping paper. The above writer and others, having been feasted by the Indians for some time on these cakes, found them somewhat dry at first in the mouth, but quite sweet and easily chewed, and a real luxury eaten with the juice of preserved peaches. The Indians often mix their newly ground corn with pieces of meat, and red and green peppers, and put between soft corn husks and boil them.

Corn cakes are among the choice specimens of American cookery throughout. They require finely ground meal, which is usually sifted. If the meal is scalded the night before the batter is made, they may be wholesome and sweet, if only mixed with salt and water, and baked on a griddle, or in a bake pan over a brisk fire. But they will be lighter for a little baking-powder, or soda and acid, in the right proportions stirred in, so as to gain the full effect of the effervescence. Tartaric acid, or vinegar, or still better, sour milk or buttermilk answers very well for the acid. An egg or two to the quart of batter, broken in, makes the cake superb. The effect of scalding the meal over night is to make it sweeter, by inducing the saccharine fermentation. If the batter is thin, the cakes may be baked rapidly over a hot fire; if thick, slower baking over a slower fire is better. When the batter is mixed with buckwheat, or coarse flour, or fine, the flavor may be improved. For sedentary persons, or those subject to constipation, a liberal addition to the batter of wheat bran is a great improvement. Cakes of a remarkably delicate taste are sometimes made of the fine flour of corn-meal sifted through a gauze sieve. Eggs, butter, sour milk and soda are usually added. What does not pass through the sieve makes a very fine samp.

The common bran sifted out of corn-meal, thrown into water, will separate into two portions; the broken epidermis remaining for a time on the surface; the coarser and more oily parts of the kernel sinking to the bottom. The latter, after considerable boiling, is very nutritive and agreeable to the taste.

(*l*)—*Hasty pudding or mush* has been a staple article of American cooking from time immemorial. The Apaches, one of the tribes inheriting the ancient Indian customs, cook their mush in flat, water-tight wicker baskets. Wooden tongs with charred ends, are used to throw into the presumably

wet mass, stones heated very hot, which are incrusted with this rudely mixed batter, and taken out when cooked; new ones being put in. The stones are then relieved of the cooked mush adhering to them, and the process continued till the meal is all cooked; when the family are gathered round and scoop out the contents with their fingers. This is very much like South Sea Island cookery.

Carl Heller speaks of corn-meal boiled in water, with various roots, as one of the standing Mexican dishes. Our Puritan ancestors, for many years after they landed at Plymouth are reported to have made their suppers on mush and milk. Acting on different principles from those of undying hate, life-long revenge, torments for the poor captive, and punishing the guilty by slaughtering the innocent, which have been the main causes of the thinning out of the savages and the slow advance of their arts of living, these fathers of our social progress could afford to cook their mush in geometrically shaped kettles, and eat it out of nicely glazed bowls, with handsome plated spoons. As now commonly cooked in the United States, the water in the kettle is first brought to a boil, and the sifted meal then stirred in gradually, and salted, stirring all the time to break the lumps, and secure an equal distribution of the heat. Mush is best made thin, and allowed to boil some time after the materials have been well stirred together. Cold mush is capital, cooked up with milk, or fried in lard. Mush and milk is an excellent diet for young children to grow upon—and as an occasional dish for adults, is quite a luxury. Those wishing to inquire further into the virtues of Hasty Pudding, are referred to Joel Barlow's poem on the subject, which will be found in the appendix to Allen's American Farm Book.

(*m*)—Some of the early English authorities have been disposed to give maize a low rank as a bread corn, asserting that it cannot be made into good bread without the addition

of wheat or other flour. A few experiments made on this grain, or rather the meal, in Prussia many years ago, led to similar statements from that quarter. The Rural Cyclopedia asserted (1854) that in its various uses for human food, it was in almost all cases, more or less inferior to wheat flour, and was often mixed with that flour, like potato starch and bean meal, as downright adulteration; that many American farmers used it as bread corn only till they could afford to grow wheat; and that the inhabitants of the maize countries in Continental Europe for the most part, used it only when poverty or some other form of stern necessity, prevented them from obtaining a better. He admits, however, the use in some parts of the Low Countries, of maize flour made into paste and fried with fat bacon, as ordinary food. The above work then quotes John S Bartlett, of the New York Albion, as "a very competent witness," who speaks highly of maize as a bread corn, and of its general use in the rural districts of the United States; as making children thrive and adults labor, with no aid from wheat; as having no equal for general domestic use, where economy is kept in view, and as easily converted into puddings, cakes and bread; and as corn meal added to wheat bread, decidedly improving its quality, and causing it to be preferred at almost all American tables, giving a sweetness and freshness, unknown in purely wheat bread.

The intimation made in works published a quarter of a century ago that the eaters of maize bread in Southern Europe belonged only to the poorer classes, was not very much against its usefulness. We all know what the humbler classes in France, Italy, Austria, Hungary and Greece have been doing since that time, and how much they have accomplished towards getting into the light even in Spain, one of the oldest of the European maize eating districts. Reliable authorities that characterized the upper classes as degraded and

imbecile, spoke of the peasantry as a very fine race. Mr. Borrow, whose travels among the gipsies in that quarter excited so much attention, described the manly and self-reliant character of the poorer classes in Spain, as very much in contrast with the wealth and rank worshiping poor of England. One great difficulty in Spain, in establishing a permanent and enlightened government, has been the contempt in which the poor and proud Spaniards hold their leaders. The nature of the "depressing" influence of maize eating in America of which one of our agricultural writers speaks, was fairly exhibited in the history of the Pilgrim fathers. It was the kind of depression that rejected the teas and other luxuries of England when they became a badge of political slavery. It was the kind of depression which resulted from the breakfasts of George Washington, which were said to have been by rule four buttered corn cakes; and which was shown in the doings of the Green Mountain boys at Bennington; and in the preference of Marion and his corps for a dinner of sweet potatoes roasted in the ashes in the woods and swamps of the Carolinas with liberty, to the rich feasts of the British officer, who was fastened by red tape to the feet of tyranny.

Mr. Ben. Perley Poore, in his History of Agriculture, (U. S. Agricultural Report, 1866,) gives due credit to the depressing effects in the case of the old fashioned New Englanders, long lived and large hearted, whose maize and rye bread dinners, and mush and milk suppers distinguished them from their luxury loving descendants. The fact is, the grand truth that man does not live by bread, alone, has a great deal to do with the condition of a people; much more than the kind of bread they eat.

Some of the reasons why wheat as a bread corn should have the advantage of maize in cities and towns where the main reliance is on baker's bread, have already been stated. The fact that maize is especially prized for warm bread, and

wheat for cold, shows why it should have obtained predominance at a great many farm-houses, where the exigencies of the table require the bread baked sometime beforehand, and in comparatively large quantities. When cold corn bread is brought to the table, it is generally warmed over. The mixture of rye and Indian, or wheat and Indian were formerly baked in large quantities.

It is true that once in a while an American farmer speaks with contempt of corn bread, but the abundance of old and new recipes for this article, often represented as producing something "splendid," or "fit for a king," show how well it is appreciated in a great many quarters. At the tables of well to do farmers it has been common to have both wheat, and corn bread or cakes, at the choice of the participants, and so far as the author of this has had an opportunity to observe, the warm corn bread was disposed of as quickly as the wheaten loaf. He has remarked the same thing at the best tables on Western Steamboats. A large proportion of hired men on farms in the United States (leaving out negroes, who have been great corn eaters) are either emigrants, or descendants of emigrants from the Northern European States, where maize is little cultivated, and its uses, (except in feeding animals,) comparatively little known. Between 1830 and 1860, about 4,800,000 alien passengers had reached the United States, of which more than one-third were entered on record as farmers or laborers, and probably nearly all of them unused to corn bread, or corn as food before their arrival here. Many of the Irish have a distaste for corn as food in any shape, unless it be that of roasting ears The Irish are remarkable for their adherence to old tastes and customs. Nearly the same proportion of emigrants from 1856 to 1868, of those whose occupations were noted, were farmers or laborers. Testimonials as to the use of corn meal for bread appear in the U.S. Reports for 1849 and 1853, from Vermont,

Massachusetts, New York, Rhode Island, Pennsylvania, Maryland, Virginia, Mississippi, Missouri and Ohio.

The difference between wheat and corn bread is more in bulk for the same weight, and general appearance than in amount of nutriment. What makes wheat flour swell so much with yeast is its gluten; the corresponding nitrogenous material in maize being *zein*, which in rising gives less bulk.

Corn bread may be made with or without leaven. Perhaps the simplest form is the corn dodger, which is often merely scalded meal, made into dough with salt and water, and slowly baked in a bake-oven or otherwise. With plenty of buttermilk, it eats well, cold, for a bite, when one is hungry in the field. In the early settlements of West Kentucky it made a great part of the dinners of school children, when home was too far off, and too many hours in school were required to admit of going home for a warm dinner. Another style of unleavened corn bread was mixed up of meal, salt and water, and spread on a smooth long board, and placed before a blazing fire in the old fashioned fire-place. The position of the board was carefully changed until the cakes or loaf were well done throughout, and without burning. The author remembers eating, more than half a century ago, from a loaf baked in this way, one evening at a log farm-house, where he stopped for the night on his way to college. It was very much relished.

Corn-meal mixed with wheat or rye flour, makes very good bread, warm or cold. The rye and Indian corn bread was referred to by Plantagenet in describing the productions of New England in 1648. It requires long baking, but is quite agreeable and wholesome, eaten warm or cold.

General Recipes for corn bread.—Unleavened. (1.)—One quart of sweet milk, a little salt, sufficient meal for very thick batter; let stand one hour or more, ready to bake; mixture should be thick enough to be taken up and rapidly moulded

in the hand, without dropping back into the mass; if not, thicken or thin as required. Lay the dodgers in hot, well greased pans and bake in a well heated oven, in sheet iron, or better, cast iron pans.

(2.)—Take half a gallon of milk, add one half tea-cup full of grease, (any meat fryings,) salt to suit, mix with water, stir well with the hands; make into pone about half an inch thick; put in a well greased pan and bake in a well heated oven. This for a family of three or four.

(3.)—Take two quarts sweet milk, boil one quart, and while boiling, stir in as much fine Indian meal as will make a very stiff batter, add a spoonful of salt, and make very sweet with molasses. Butter a pan, pour the batter in, and the remainder of the cold milk on it. Cut little bits of butter and put on top, and bake two hours in a moderate oven. Said to taste like custard.

(4.)—*Lightened* corn bread. For a family of four persons, take one pint sweet milk, and one pint sour milk, ½ tea spoonful of soda, one table-spoonful of sugar, a lump of lard the size of a hen's egg, a table-spoonful of salt and two eggs, and stir in enough sifted corn-meal to make a stiff batter. Pour the batter into a stove pan, and bake in a hot oven one half to three-quarters of an hour.

(5.)—Boil three quarts of water and thicken while boiling as for mush, as long as you can stir it; set off, when cool enough to bear the hand; work in one table-spoonful of salt, two of lard, two of molasses, and as much meal as you can smooth over. Let it rise six hours; bake two hours in any old-fashioned Dutch oven by a fire place.

(6.)—Scald one quart salted corn-meal; work when cool with the hands; add one table-spoonful of yeast, three of molasses, and wheat flour to mould with; let stand till it cracks on top; bake one hour.

(7.)—*Lightened pone.*—Pour boiling water on a half gallon

of corn-meal, mix to thick batter; when cool enough, put in two table-spoonfuls of lively yeast, and one of salt; stir well and set by the fire to rise; put in pan when light enough, and bake in a stove oven.

(8.)—*Steamed mixed bread.* Two cups corn-meal, one cup flour, one cup sweet milk, one cup sour milk, half cup sugar or molasses, one tea-spoonful soda, and another of salt; steam three hours.—Splendid.

(9.)—One pint corn-meal, one pint wheat flour, one table spoonful salt, half tea cup sugar, one tea-spoonful soda; mix well and add buttermilk to make a thick batter; then add two-thirds cup melted lard and two eggs, stir thoroughly, pour into pans well greased; the batter being one inch thick, bake in a quick oven twenty minutes, and serve hot.

(10.)—One egg, three cups meal, one cup flour, one cup molasses, two cups buttermilk, a little salt. Dissolve a tea-spoonful of soda in a little cold water, and stir in just before pouring into the pan; bake rather briskly.

(11.)—Scald the meal, mix the batter with milk, add one egg and a little lard, with a tea-spoonful of soda, stir well together; bake three quarters of an hour.

(12.)—Scald at night two handfuls meal and a coffee cup full of new milk; wrap close in a table-cloth. In the morning put a cup of tepid water over this and stir in flour to make it of a proper thickness. For salt-rising bread, add a little salt and keep warm until it rises. Bake by 10 o'clock.

(13.)—*Boiled corn bread.* Two cups corn-meal, one cup wheat flour, half cup molasses or brown sugar, one pint sour milk, one and a half tea-spoonfuls soda, one tea-spoonful salt; mix well, put in a well greased tin pail, cover tight, set in a kettle of boiling water; cover and boil two hours.

A suitable portion of wheat bran stirred in corn bread and cakes makes them more wholesome, as it does wheat flour bread.

(14.)—*Indian corn pudding baked.* Scald one pint sweet milk (do not let it boil,) take a half pint of corn-meal, moisten it with cold milk; stir in the scalding milk, take one egg, beat well with sugar, add the milk to the egg and sugar, and stir into the pudding, spice it and add a little salt, and a piece of butter the size of an egg. Bake one hour.

(15.)—Scald a quart of milk, steep a tea-cup full of Indian meal and three tea spoonfuls wheat flour in cold milk; stir it into the boiling milk, add a tea-cup full of sugar, a tea-spoonful of cinnamon and half a tea-spoonful of salt. Mix and bake slowly four or five hours. Skim milk best for pudding.

(16.)—Boil one quart of milk, add nine great spoonfuls Indian meal, large cup of molasses and a small tea-spoonful of salt. Lumps all mashed, add one quart cold milk. Bake four hours in a moderate oven; eat with butter or salted cream.

There is little doubt, in looking over these recipes that very palatable bread and puddings can be made from corn-meal with the addition of a few ingredients easily obtainable at a farm house, or where one or two cows are kept; but they require some time and trouble, and the expense of fuel is something. The dishes thus prepared would not be easily salable as separate articles, especially by the side of the various delicacies prepared from wheat flour. So that whenever the demand at boarding-houses or restaurants, or at private tables is for ready prepared bread, corn-meal could not supply it as wheat flour could. But wherever articles for the table are habitually served up warm, the preparations from corn, including green corn, hominy and meal, may be made equally palatable, and a great deal more economical.

An account of an experiment made at the instance of the Editor of the New York Albion, was (on the economical value of mush and milk) substantially as follows: He carefully weighed out one pound of meal, and gave it to a person who understood the mode of cooking. In boiling, it ab-

sorbed about five pints of water, which was added at intervals till the process was complete. The bulk was again weighed, and gave as the result four and a half pounds. Such was its power of expansion. Dividing the mass into portions, it filled four soup plates of ordinary size, and with a little milk and sugar, gave a plentiful breakfast to four servants and children. According to this experiment, one pound of maize flour, costing one penny, would give breakfast to four persons at one farthing each. Adding to this another farthing for milk, sugar or butter, the breakfast would cost one half penny each, and would be an ample meal for females and children.

"Thousands of working men have gone to daily labor during the past winter with a much more scanty breakfast. Equally adequate for other meals, particularly supper. People in rural districts, instead of becoming tired of the article, become more attached to it. The principal auxiliaries of mush are sugar, molasses, treacle and butter; milk best of all, a small quantity of which gives it a most agreeable flavor and renders it highly nutritious."

Some experiments were made in the fall of 1875 and the succeeding winter on various articles of food, the quantities and cost of the different articles used being carefully noted from day to day, and the results as to health &c.—Among these were,

1st.—One week (Oct 12 to 18, inclusive) on wheat flour 6 lbs. costing 25 cts. made into griddle cakes with wheat bran 3 cts., vinegar, salt and soda 3 cts., and lemon cakes, 3 cts., mutton $2\frac{1}{2}$ lbs. 15 cts., herring 5 cts., corned beef 8 cts., tea, coffee and sugar, 14 cts. . . . . . Total 76 cts. One or two hours daily exercise, most of the time reading and writing. Indigestion.

2d.—One week (Oct 30 to Nov 5, inclusive) white flour bread bought at bakers $\frac{2}{3}$ fresh, $\frac{1}{3}$ stale $14\frac{1}{2}$ loaves, 64 cts., tea and sugar 10, meat 15, Total 89 cts. One or two hours daily exercise, most of time reading and writing—good digestion, but tendency to costiveness.

3d.—One week (Sept 20 to Sept 27,) on mush from three quarts corn-meal costing $9\frac{3}{8}$ cts., and $\frac{3}{4}$ quart wheat bran 1 ct., bacon $1\frac{3}{4}$ lbs. $31\frac{5}{8}$ cts, tea, sugar and salt, 13 cts. . . . . Total 55 cts. Five hours hard work every other day, rest of time except sleep, reading and writing.—Very good health.

4th.—One week (Sept 27 to Oct 4,) on corn cakes from six quarts Indian meal at $1.00 per bushel, 18¾ cts., wheat bran say 4¼ cts., salt, vinegar and soda 2 cts. corned beef 1½ lbs. 10 cts., tea and sugar 13 cts. . . Total 48 cts. Some hard work, reading and writing, and health.

5th.—One week (Nov 23 to Nov 30,) rye-meal 13 cts., corn-meal 10 cts., beef bone and pork 8 cts., tea, coffee, sugar and apples 18 cts. . . . Total 49 cts. Brisk exercise and good health.

6th.—One week (Dec 1 to Dec 7, inclusive) corn-meal cakes from 7⅓ quarts meal 17 cts., wheat bran 3½ cts., tea, sugar and soup 8 cts., one loaf white flour bread 6 cts. . . . . Total 34½ cts. Copying.—Good health.

7th.—One week on parched corn from 14½ ears of maize 8½ cts., tea and sugar 6½ cts. . . . . Total 15 cts.

The corn was first parched; then beaten fine and sifted, and the coarser parts boiled again. But little exercise was taken; there was a feeling of the want of usual vigor, but no hunger or material falling off in flesh. It would answer very well for an occasional week of fast.

8th.—Two days (Jany 10 and 11, 1876,) on pop-corn 2½ pints shelled, costing 6 cts., tea, sugar and apples 5 cts. For two days 11 cts., or 5½ cts. per day.

The seventh of the above experiments is only valuable in showing what can be done in cases of extremity to sustain life (as in times of prevailing famine,) or in very peculiar circumstances requiring close application with very scanty means of support. It has been stated in regard to certain students of Divinity, who afterwards became active and prominent ministers, that during part of the term of study, their food cost only $5.00 a year. This would be nearly at the rate of ten cents per week. Probably the quantity consumed was greater, and the price per bushel less than in the above experiment.

As to the first six experiments—their value is chiefly referrible to special cases of a different character, as where one is deeply in debt, and finds the best way to get out is by economy in the style of living; or when one of narrow means wishes to indulge in the luxury of giving liberally to some good object; or when one of slender income is occupied with some useful enterprise that does not pay; or where a man with a growing family and moderate means is anxious to secure the ownership of a pleasant home.

For those who have secured a fair income, and especially, for those of ample means, a more liberal style of living has many advantages. A temperate use of the abundance with which the Ruler of the Universe has blessed this country is best for the individual, and for the society in which he moves. A somewhat liberal scale of expenditure is most favorable for the cultivation of one of the prime virtues of civilization —hospitality. It leads more, but is not necessary, to that kind interchange of civilities and good offices, which, with the cultivation of other virtues, extends one's influence most widely and most usefully. For those professions and occupations which require for success, an extended acquaintance or a free intermingling with general society, even an expensive style of living is often an immediate advantage. This may be all right, if the individual spends only his own means, and not other people's or what ought to be other people's. As to *high* living, the example, and the effect on society at large are to be considered, as well as the means, honestly acquired, of the individual.

When it is important or necessary to practice the strictest economy, the advantage of living on the preparations of the maize plant will be clearly seen. One of the most healthy and nourishing of these is the ear of sweet corn when it is getting a little old, but before perfectly ripe; the soft kernels being grated off the ear, and eaten with butter or rich soup. As the analysis of sweet corn by Dr. Salisbury has not yet been given, it is here annexed, being taken from an article in the Ohio Agricultural Report for 1858, by Mr. J. H. Klippart, whose name is so largely associated with the late progress of agriculture in Ohio. It is there quoted as Dr. Salisbury's analysis of this variety. In 100 parts, starch has 11.60 parts, gluten 4.62; oil 3.60; albumen 14 30; caseine 5.84: dextrine 24.82; fiber 11.24; sugar and extractive matter 14 62; water 10.32. The extraordinary amounts of albumen, sugar and dextrine show remarkable qualities for nutriment and digesti-

bility. Most of the starch seems to have been changed into dextrine; becoming thereby more soluble; but both together are much behind the ordinary proportion of starch in the corn grain. The large quantity of fiber seems due to the greater surface of the epidermis made by the shriveled condition of the grain. The nitrogenous matters here foot up 24.76. The same analyst gives pop corn, starch 46.90 parts, gluten (including some sugar,) 9.24, oil 6.96, albumen 5.02, caseine 2.50, dextrine 2.25, fiber 8.50, sugar and extractive 7.02, water 12.12. In his analysis of the Tuscarora variety, the gluten and oil are undetermined, but the albumen and caseine are reckoned at 11.04; the starch 48.90, sugar and extractive 10.00, dextrine 2.00, fiber 14.00 and water 13.68.

(11.)—*Sugar and syrup from maize.* About the year 1843 it was found that tolerable syrup could be made from the expressed juice of the maize stalk, cut at a proper time after plucking the ears for roasting; and by planting so thick in the rows that the corn could not come to ear. A still larger quantity of juice could be expressed from stalks of a more convenient size. Mills were contrived of a more simple character than those used for grinding sugar cane, but working on a similar principle. Experiments were made on a somewhat extended scale in the East and West. A report of the results in this line by John Beal, of New Harmony, Ind., appears in the U. S. P. O. Report, for 1843. He had the ground prepared as for other corn and planted in rows three feet apart, so as to leave the stalks three or four inches apart in the drills; the corn cultivated in the usual way, and kept clean. As soon as the ears began to form, or about the time they showed silk, they were pulled or cut off, and so from day to day as long as there appeared any disposition to form ears. It might be planted in the climate of New Harmony any time from April 15th to the last of June, and would ripen from August 18th to the last of September. When the blades

began to die about the middle of the stalk, it was to be cut and the juice pressed out. The blades were stripped off when the stalk was ripe; the instrument recommended for this was a hooked knife, the hook about four or five inches, semicircular, fitted on a straight tongue, suitable for driving into a wooden handle about twelve or fifteen inches long. One blow with this would cut off the top, and the same knife would cut the stalks at the ground. The tops and blades were to be secured for fodder, and the stripped stalks (just enough being cut for pressing that day) were carried to mill. This was composed of three wooden rollers fixed upright in a frame, similar to an apple mill. The center roller had a shaft run up through a frame of sufficient height for the lever which the horse turned it by, to clear a man's head. The center roller had cogs on it, working in holes in the two side rollers. The rollers were 14½ inches in diameter &c.

When operating, these rollers crushed the stalks as they were passed through, and the juice was caught by a trough fixed underneath, and conveyed to a tub, to be carried to the boilers. The arrangements for boiling were such as to boil down the juice as rapidly as possible; the granulation depending on this. Mr. Beal boiled down the juice in about two hours, in three iron kettles from eight to ten gallons each, fixed in a brick arch, one kettle only immediately over the fire; the blaze and heat passing under the other two, through flues four inches deep; the bottoms of the kettles only being exposed to the fire. The juice was first passed through a sieve, and lime-water, one table spoonful to a gallon added; then put into the kettle farthest from the fire, and well skimmed before coming to a boil; then passed to the next kettle, and fresh juice put in the first; then passed to the last kettle over the fire, and boiled as rapidly as possible, and scum removed as fast as it appeared; the granulating point was when it would raise Fahrenheit's thermometer to between 238° and 240°.

At 218° it began to rise up, and would flow over the top of the kettle, if small portions were not then taken out with a ladle from time to time, and poured back again. At 225° or 226° it began to thicken and settle down in the kettle, not rising again. The heat was raised 12° to 14° more before finished; which was known by a smell of burnt sugar, the difficult bursting of bubbles with puffs of steam rushing out, and (a small portion being taken between the thumb and finger, and moderately cooled) by the drawing of a thread more than half an inch long. Mr. Beal's syrup did not commence graining till from twelve to forty-eight hours after it was taken from the kettles. The syrup when cool was poured into common sugar or flour barrels, where it grained, and the molasses flowed out through a small hole in the bottom.

The molasses was rather more acid than cane molasses generally is; twenty moderately grown stalks yielding a gallon of juice, from which one-tenth to one-eighth syrup was obtained; one pint of syrup weighed one and a half pounds, and would yield by measure one-fourth molasses and three-fourths sugar. The stalks all raised on upland.

The experiences of Messrs. Plummer, Deaderich, Adams, Humphrey and Tillotsons, in making sugar or syrup from corn stalks, are also given in the U. S. P. O. Report for 1843-44, with methods and machinery somewhat differing from the above; the places of trial being in different sections of the Union. The last named were Louisiana planters; and their experience was against the profitableness of the maize sugar planting, as compared with that of the cane. They speak of one great advantage the sugar cane has, in being planted only once in three, four or five years; six to eight hogsheads of sugar the produce of one planting. Mr. Webb, of Wilmington, disputed the inferences of Messrs. Tillotson from their experience of maize sugar planting. Perhaps it is more suited to the Northern stature and size of the stalk, than that

of the Southern; although it seems to be a general fact that saccharine matter forms more abundantly in Southern than Northern latitudes. The Mexicans and other Southern maize growing nations made what was called *honey* from the stalk hundreds of years ago. If the cane supply of sugar should ever be cut off from this country, or any part of it, it is very probable that either the maize or beet, or both, may in some degree be substitutes.

(III.)—*Whiskey from maize.* The nature of strong liquors as drinks, seems to have been as well understood 2,600 years ago as it is now. It was King Lemuel's advice to give strong drink to him who is ready to perish. Its value for this purpose was appreciated when 140 were dying per day, of the Cholera, in one of its earliest visits to Cincinnati. Some who oppose its use as a beverage, employ it as a remedy in cases of Asthma, and other complaints. Modern science has found it beneficial in many of the arts, especially when the distillation is carried further, and it becomes alcohol. This is important as a solvent in chemical analyses. It is one of the accepted agents for preserving valuable substances from decay or decomposition. A familiar instance of this is the substitution of whiskey for water in dissolving ink powders, —the ink will not freeze in that case. Those who are curious to know the processes of distillation, will find them in the American, one of the latest of the Encyclopedias. The consequences of its continued use as a beverage are too well known to need repetition here. The strength of the appetite for whiskey when once formed, finds a good illustration in the early military history of this country. The most common punishment for disobedience, lawlessness or unfaithfulness in a soldier, was stopping his allowance of whiskey; as appears from the order books of some of the detachments that protected the infant settlements in Ohio.

The U. S. Government, in its earlier as well as later years,

has encountered much difficulty in attempting to tax this article. Soon after the formation of the Constitution, Congress laid a duty on distilled spirits, and in 1794 meetings were held in Western Pennsylvania, which resulted in the organization of some seven thousand insurgents. The marshal of the United States was forced by armed men into an agreement to desist from the performance of his official duties. Fifteen thousand men were called out under President Washington's requisition from the four States nearest the theater of insurrection, and marching under Gov. Lee soon made an end of the outbreak.

In the late taxings of the manufactured article, under the United States laws, it was found that by making the tax $2.00 per gallon the revenue from this source was greatly reduced. It was asserted by one of our most reliable journals, that at that time, the value of distilled liquor produced was not less than $100,000,000. The revenue was much increased by lowering the rate to fifty cents per gallon.

The great maize growing States seem to abound most in products of distillation. The Mexicans and Peruvians made intoxicating liquor out of maize. So do the Indians of the far West. The Apaches in 1870 were said to make strong drink called *tisween*, out of maize. They soak the grain twenty-four hours, then dig a hole in the ground, generally in the wigwam, and cover the bottom with dry grass; the corn is then laid in, and covered with grass; warm water is sprinkled over it four or five times daily; at night the family sleep on it to increase the heat caused by sprouting, and in four or five days it is ready for the next operation. It is then dried, pulverized, and boiled five hours, when cooled mixed with sugar and flour, and left to ferment for twelve hours, when it is ready to drink. The exports of whiskey are quite small in comparison with the product. There is a large internal trade in the article. Much of the corn imported into Cincinnati is con-

sumed by distillers. The United States Census for 1870, gives the following details as to the manufacture of distilled liquors:

XLVIII.

Census Year.	Distilleries.	Employees.	Capital Employed.	Raw Material.	Product.
1850	968	4008	$5,409,334	$10,543,201	$15,770,240
1860	†1193	5416	11,548,675	18,330,713	26,768,225
1870	† 719	5131	15,545,116	19,729,432	36,191,133

† Establishments.

In 1850 there were also 38 rectifying distilleries producing $791,030. It is not stated how much of the raw material was corn. In 1870 the census gives the largest number of distilling establishments in the United States to Kentucky, 141; the next largest to Pennsylvania, 108; the next to Ohio, 63. The largest amount in value was produced by Illinois, $7,888,751; the next by Ohio, $7,022,656; the next largest by Pennsylvania, $4,618,228; and by Kentucky, $4,532,730. Statements from Treasury Department of the United States for 1869, gave as the total number of gallons produced and accounted for during the year ending June 30, 1868, as 16,396,351; and during the year ending June 30, 1869, 56,183,577; and as the amount of the tax collections for the fiscal year ending June 30, 1870, $55,000,000. There was withdrawn of that which was produced prior to July 1, 1868, from bonded warehouse from that date to June 30, 1869, in gallons 24,479,512 The revenue collections from spirits in 1875 were some $7,000,000 larger than those made for 1869. Alcohol was formerly used as a burning fluid, especially for cooking oysters.

(IV.)—*Starch from maize.* Starch is made from wheat and potatoes as well as maize. It was one of the articles yielding revenue under the excise laws of the United States.

Starch is manufactured for food as well as laundry purposes. In 1863, the collections on that manufactured from corn, at the rate of 1½ mills per lb., amounted to $11,763, 96cts., showing the quantity taxed to be 7,842,640 lbs. By the U. S. Census for the three last decades, there were for making starch:

XLIX.

In year.	Establishments.	Employees.	Capital Invested.	Raw Material.	Product.
1850	146	694	$692,675	$799,459	$1,261,468
1860	167	1073	2,051,710	1,380,000	2,823,258
1870	195	2072	2,741,675	3,884,909	5,994,422

In 1870 New York made the most starch, by Census $4,678,413.

For the various methods, new and old, of preparing starch from maize, and other raw materials, the reader is referred to the American Cyclopedia.

(v.)—*Oil from maize* is more or less developed during its distillation for spirits, but little is said about it. The New England Farmer, of June, 1829, speaks of it as obtained from the mash, or that which is fermented for distillation. Two quarts of oil were obtained from four bushels of corn. It burned brilliantly; was said, as a medicine, to be as effectual and mild as castor oil. The oil was separated, or made to rise on the tub, by a process accidentally discovered; the secret not disclosed. As long as we have petroleum and lard oil in such abundance, it is not likely to become an article of extensive manufacture. Dr. Jackson reported a little fixed drying oil found in the corn cob.

(vi.)—*Mattresses* continue to be made from corn husks, and they are often used for re-filling beds. This use of the corn plant has been occasionally referred to in the U. S. P. O. Reports. A correspondent from Memphis, Tennessee, in 1849, says the husks were preferred to moss for mattresses,

as being cleaner, and more easily manufactured. When mixed with coarse cotton, and properly prepared, they made a mattress little inferior to curled hair; the price being about 50 cts. per cwt. Husks have been occasionally seen in the Cincinnati markets in bags. They are generally slit into narrow strips to make the mattress more elastic. Husks are braided into mats placed at the front doors of dwelling houses.

(VII.)—*Paper from maize husks and stalks.* (See U. S. P O. Report, 1863.) There were two manufactories of maize paper in the Eighteenth century. In 1802, Burgess Allison and John Harkins, of New Jersey, obtained a United States Patent for making paper of corn husks. In 1838, Homer Holland, of Westfield, Mass., obtained a similar patent. One was issued in 1860 by the United States, for making pulp of corn cobs alone, or cobs and husks together. Recently, a Bohemian, having shown the Austrian Minister of Finance a process for maize paper making, which was tried at Schlogelmuhl by the Imperial paper mill, and proved a failure,—certain experiments on the fine husks enclosing the maize ear were continued till a new fiber for spinning and weaving was discovered; its waste being a material for cheap paper. The cloth produced was considered a good substitute for common flax and hemp linen, oil-cloth, tar-cloth, &c.

The process developed fibers, flour dough and gluten; the fibers were spun and woven, the flour dough made into agreeable and wholesome nutriment, and the waste, consisting of gluten and broken fibers, was made into paper. Good paper was also made of the maize cloth when reduced to rags. The steam boiler used for reducing and separating the elements from the raw plant, was heated by fuel from the stalks.

Among the resulting manufactures at the Imperial mill at Schlogelmuhl, which have been quite a success, are strong and durable parchment, and document papers; very transparent and tenacious tracing papers, ("an effect of the natural

gluten of the husks; ") and very cheap letter paper of various styles and colors, with a smooth and polished, but soft surface, which takes the ink kindly; chancery papers of great variety, the size very heavy and durable; beautiful silk paper of several colors, of wonderful delicacy in structure and finish; paper for making artificial flowers, in lilac, rose, blue, green and brown, gossamer like, yet strong, weighing but six pounds to the ream, and cigarette paper seven pounds to the ream. Of most of these varieties, both machine and hand papers are produced. The peculiarity of this paper is due to the large proportion of gluten it contains. The process of manufacture is simple; the humblest laborer, with a little instruction, understanding and practicing it with success.

CHAPTER VIII.

CLIMATE SUITED TO MAIZE CULTURE.

Climate, as relating to the culture of Indian corn has respect to solar heat, air and moisture, and the various conditions of growth and health, vegetable and animal, arising therefrom. This may be thought a broader definition than the case requires; but when we remember how much depends, for the success of this crop, on steady and timely industry in the processes of culture during the very months when the most fatal climatic diseases are the most prevalent, we will see the importance of including salubrity of climate among the more important conditions. Keeping in view what has already been stated touching these climatic relations, under the heads of Analysis, Distribution, History, Statistics, Varieties and Uses, and referring especially to what has been said on the subject in pages 17, 34, 35, 138, 141 and 144, we may find it sufficient to set forth some of the more important

principles underlying the relations of climate to culture. Solar heat depends on the latitude, the elevation above the sea, the nature of the surface, the position as regards the ocean, or large bodies of water, or chains of mountains.

The atmosphere has an average height and character, which long ages do not seem to alter essentially, although there are constant changes going on within its limits. The quantity of moisture accessible to plants depends on the nature of the prevailing winds, as influenced by the above named causes, producing rainfalls; or it is affected by the deposit of dew, or the capability of the land for irrigation. The subject is fully discussed, and the chief points made clear by apt illustrations in various articles in the U. S. P. O. and Agricultural Reports, among which may be especially noted, Climatology in the Volumes for 1853-54. Meteorology and Agriculture, for '55, '56, '57, '58, and '59, the last four by Prof. Henry; and Prof. Poëy, for 1869-70, and tables of variations of temperature and rainfall, in most of these reports from 1849 to 1870.

Electricity has some bearing on the subject, and its leading principles are explained by Prof. Henry in that for 1859 —also the subject of atmospheric humidity, by J. S. Lippincott, in the Report for 1865.

As the fodder from the maize plant, and the crop grown especially for the fodder are becoming, more and more, important parts of our subject, the limits of successful culture, as depending on the ripening of the grain, may be considered as transcended in various quarters. But confining the present discussion to the maize climate of North America, the statement of the maize limits by Mr. Blodget, in carrying out his theory of the 68° mean heat for July, as the fixed requirement for its profitable cultivation, will be an important aid to the inquiry. All South of the limiting line he considers within the maize region, except some mountainous tracts in

Northern New England and New York, some parts of Canada West, and nearly all those parts of the Great Western plains and the Rocky Mountain system, which are incapable of irrigation, or arrest no water from the mountain sides. Beginning at the Atlantic coast at the Bay of Fundy, and the valleys of New Brunswick near the 46th parallel of latitude, and extending from West longitude 64° to 67°, thence to the highlands of Maine below 45°, and in New Hampshire to 44°, thence ascending to 47½° at St. Ann's, near Quebec on the St. Lawrence in West longitude 72°, thence to 82° West longitude at Lake Huron in the river valleys, and favorable locations up to latitude 46°. We have now reached an elevated region, which, as well as the influence of the Great Lakes, reduces the midsummer heat so as to bring the limit ing line down to 45°, which continues almost to the Mississippi. It then rises abruptly to latitude 50°, near where the Red River of the North empties into Lake Winnepeg, where a lower surface makes the climate warmer in 97° West longitude. This is supposed to be its highest latitude, giving on that Meridian 23° of latitude for the development of the maize plant in the United States, and 35° for North America, fully equaling in value any other. Westward of 97° the range is irregular and exceptional. Special points on the upper Missouri admit of maize culture to the base of the Rocky Mountains as far as 47½° North latitude, and to the same latitude on the West of that chain; and the lower valleys of the North fork of the Columbia carry it up to Fort Colville near 49°. Mr. Blodget here remarks, that "much the larger portion of this great elevated interior mass Southward to New Mexico admits but a partial and imperfect cultivation," and that "*at* 120° *of longitude the maize range ceases for all latitudes on this continent*, but between 97° and 120° the whole continent is embraced, south of the points just named, and with the exceptions mentioned as belonging to all the

Rocky Mountain plateau north of New Mexico." As exceptions to the statement *italicised*, of the maize range ceasing for all latitudes on this continent, the valley of the San Joaquin and Sacramento rivers in California, are stated by the same writer on the second page previous, as having a sufficiently high and equable summer temperature 'for the growth of Indian corn, or one great enough to render the curve of daily change unimportant as an obstacle.'' The Pacific coast line, from Puget's Sound to San Diego, has a very low mean summer temperature throughout, ''no month attaining a mean of 65°, the July mean being under 60° from the ocean to the coast range of mountains; the low points of which, are the occasion of the same low temperature reaching the interior as far as the chief mountain ranges.

* Later statements, including some accounts of recent maize culture in California, and some accounts of the silk culture there, in the U. S. Agricultural Report for 1868, giving statements of temperature, must be admitted as modifying the above. It is there stated, that ''all of California, except a strip within fifteen miles of the ocean, from Point Conception to Cape Mendocino, and forty miles wide north of Mendocino, and the mountains more than 3,0 0 feet above the sea, is suitable for the silk worm,'' which thrives best, ''other things being equal, in a place where the thermometer reaches 65° in May, and stands about 75° in June and July, as it does at Los Angelos, and nearly all parts of the Sacramento Basin."

The exceptions due to the Rocky Mountain plateau, may be more apparent after a few general statements as to the whole face of the country of the United States. Extending from the Atlantic to the Pacific, it has two great mountain systems, or swells of land; the Alleghany, averaging 3 000 feet above the sea, nearly parallel to the former coast; and the Rocky Mountains to the Coast Range, averaging about

5,000 feet elevation, pressing hard on the latter. Individual ranges and peaks, however, have in each system, a very much higher elevation than the average. From the South to the North, these spread apart, leaving the great Mississippi valley in the middle. It slopes down to the Gulf of Mexico, from a dividing ridge about 1,200 feet above the sea. Beyond the sources of the Mississippi, the lower land slopes northward, with the basin of Hudson's Bay, and the valley of Mc Kenzie's River, to the Arctic Ocean; making a path for the Polar winds. From the Gulf of Mexico come up the south and south-west winds, laden with rain clouds from that great evaporator, to fertilize the eastern half of the United States; the Allegany ridges being nearly in their direction, and suffering them to pass on either side. This eastern, rainy half extends west to about the 98th meridian of longitude west of Greenwich. West of that, except on the Pacific coast, and on the mountain sides, the general tendency is towards dryness—in some places of an extraordinary character. This has been supposed to be owing to the lofty coast and rocky ranges preventing the free passage of the rain bearing winds from the Pacific, or perhaps robbing them of their vapor in passing eastward; the fall of rain on the western mountain sides throwing out the latent heat, which expands the current of air, and throws it up higher; so that with its remaining vapor, it passes over the inferior middle ranges, and leaves the broad interval, except under special circumstances, without rain.

It has been said that more rain falls since the completion of the Pacific Railroad. Irrigation has been tried, with great success, in many places where rains either did not fall, or could not be relied on. Crops of the smaller grains have in many instances been enormous. Wheat, bearing so much higher prices, would be apt to engross very much more of the farmer's labor and capital than maize; for which, even in

fattening hogs, a substitute has been found in barley. Experiments, widely and perseveringly instituted, will be much safer ground for generalization, as to the climatic relations of maize to this new and vast region, than meteorological theories in the present state of the science; especially as those relations are very much controlled by local peculiarities. The native Indians, by planting in holes ten or twelve inches below the surface, have made even the arid table lands yield this grain abundantly, and the Mormons of the Salt Lake valley have done the same through irrigation. This valley is a depression, surrounded by mountains, which bring down some rain. The Smithsonian weather tables for 1868, give Great Salt Lake City a rainfall, including melted snow, in May of 2.36 inches, in June 4.00, in August 3.69, in January 2.44,; that on the hills in Cincinnati for those months of 1868 being respectively 6.09; 5.60; 4.64; and 3.72.

Wanship in Utah, has less rain; 1.45 in January, 0.70 in February, 2 inches in March, and 1.40 in December. Maize was said to be a good crop in S. W. Utah. The rains in California, as indicated by the few returns for 1868, commenced with 0.34 inches in October, and increased to 8.50 in January, and diminished to 0.23 in June; there being next to none in July, and none at all in August and September. The three places of observation were San Francisco and Monterey on the coast, and Murphy's probably in the interior.

From another table given in the same volume, in connection with an article on the silk culture, and the remarks accompanying it, it appears that there is no rain in the summer in California, and little in autumn, but there is considerable in the spring, mainly in March; the heaviest being in winter. A writer in U. S. P. O. Report, 1866, states that along the rivers in the interior, much bottom land has always yielded maize grain abundantly. But where these rivers are supplied from the snows of the sierras, the lands suitable for corn

raising are liable to overflow, as late as April, and sometimes in May, when the early hot weather sets in. In the valleys in the coast district, corn is raised in many places, the yield being large, and the crop certain. The same favorable conditions appear in the southern parts of the State, where the soil has sufficient moisture through the summer season. The most famous place for growing maize was stated to be the Russian River Valley, in Somona County.

In the report for 1869, corn was said to make good crops in many of the valleys of western Oregon, "the warm, dry summer weather of that region being adapted to its growth and maturity." It fails in Washington Territory for want of high summer temperatures. In Arizona, according to Gov. Safford, an average of thirty to sixty bushels to the acre, and with high culture 105 bushels, are obtained. It is a staple in New Mexico, growing wherever irrigation is possible. The maize crop in Colorado for 1869 reached 600,000 bushels. It thrives in the mild climates of Montana. Dakota produces all the grains of the north-western States abundantly. Before the grasshoppers cut down the maize crops, they were a great success in Kansas and Nebraska. The report on the Public Domain in the U. S. P. O. Report, 1868, confirms these statements. One passage in that report is significant with regard to the general crops of the so called Desert region. "The Jesuits, in commencing to cultivate the soil in the Bitter Root Valley, (Montana,) about twenty-five years ago, could raise scarcely anything; but continued experiment developed the proper course to be pursued, and the grounds in that region which at one time refused to yield, are now prolific with splendid crops; the incoming settlers having profited by the experience of their predecessors." Wheat was the main product there.

The facts of production already adduced, as to the maize districts east of the 98th meridian of longitude west of

Greenwich, render it almost unnecessary to bring testimony as to the climatic capabilities of maize south of the limiting line marked out by Mr. Blodget. Nearly the whole of this immense region is within the belt of rains, although occasional droughts prevail near the time of ripening, and some districts are subject to early or late frosts. Some of the districts where the climate is said to be too severe for the profitable maize cultivation of grain, are the high dividing ridge in Vermont and its northern counties bordering on Canada. In 1851 it was said to be a very uncertain crop in Washington County, Maine, latitude 45° near the eastern boundary of the State. At Cornishville, York Co., Maine, in about latitude 43¾°, in the interior, near the Saco river, it was the most important crop by far; the usual crop being forty bushels to the acre.

It appears then that the United States territory proper, with the exception of a few very elevated districts, as far as temperature is concerned, has an average climate eminently suited to maize culture. How is it with the supply of moisture? As far as rainfall is concerned, this depends very largely on the winds. The principal rain bearing winds are from the south-west and south, loaded with vapor from the Gulf of Mexico. The Allegheny mountains lie in the range of the direction of the south-west, and the Mississippi river nearly in the direction of the south wind. These are aided by evaporation from the great lakes, and to some extent from the Pacific ocean. In the extreme south, the north-east trade winds have some effect. On the Pacific coast the equatorial winds traversing the great western ocean, come in abundant supply, but to a large extent seem to leave their moisture on the western side of the coast range. A large part of the equatorial heated winds, which rise near the equator to the top of the atmosphere, and flow north-eastward, come down to the surface of the earth in about latitude 30°, and curve

round in a contrary direction, but some flow over towards the poles and become south-west winds. That portion which passes up the coast, gives it a temperature for hundreds of miles abnormally equable and warm, and fills it with vapor. It seems to be different with that portion which passes over the coast range towards the overheated plains in summer.

The atmosphere is supposed to be about fifty miles high, but the denser half of its substance is said to be included in a stratum next the surface of the earth about three and two-fifth miles deep, and one-third of it to be beneath the level of the Rocky mountains. The coast range is not much lower, and if this south-west wind in meeting it, is sufficiently cooled to lose its vapor in rainfall on the mountain side, it is so much expanded by the heat set free in condensation (according to the law that a body passing from the state of a rarer to a denser medium, throws out heat,) that it rises up high, and passes over the ranges desiccated. This is somewhat according to Mr. Espy's rain philosophy. But whatever the causes may be, it is this far western portion of the United States, except on mountain sides, and in choice situations, that lacks rain—the interval between the two great ranges, and that portion of the great plain west of the 100th meridian, and not affected by the melting of snows on the Rocky mountains. But there irrigation does wonders.

The results deduced from actual observations as to the direction and amount of winds in different sections of the Union, are given in Prof. Henry's article on Meteorology in the U. S. P. O. Report, for 1856, as based on materials worked out by Prof. Coffin of Lafayette College, in connection with the Smithsonian Institute. They are illustrated, each section, by regular diagrams, one representing the summer, and the other the winter winds of each section. Lower California for the summer is visited by winds almost entirely from the south-west; in the winter from all parts of the horizon,

but rather the most from north and west. Oregon and Washington Territories, in summer mostly from the north-west; in winter from the south-east, but still largely from the north-west. Texas and New Mexico, in summer chiefly from the south; in winter from the north, with considerable from the south. Nebraska and Kansas, in summer, chiefly from the south, the south-west preponderating; in the winter from the north-west. South Carolina, Georgia, Alabama and Mississippi, in summer mostly from the south and south-east; in winter, the winds nearly equal all round. Illinois, Wisconsin and Iowa, in summer from the west and south; in winter there is more wind from the south, and still more from the north-west; the latter would seem to be part of the polar current. In Pennsylvania, the summer winds are mainly from the west; in the winter they change somewhat in favor of the north west. In New York, the west winds prevail still more in summer; in winter, the north-west prevail. In New England, in summer the south-west prevail; in winter the north-west. The valleys of the Hudson and St. Lawrence, and the basins of Lakes Ontario and Erie, allow a flow of air from the Mississippi Valley to affect the climate locally. All these are surface winds, governed in part by mountain ranges, or river valleys. To illustrate the latter, similar diagrams are given to show the winds at Hudson, N. Y., for eight years, north and south prevailing, this being the general direction of the Hudson River Valley on which it lies; also of Albany, (12 years,) at the junction of the Mohawk with the Hudson, its winds being chiefly south and north-west. Those of Utica, (12 years,) on the east and west running Mohawk, are mostly from the west, some from the east. The Allegheny mountain range is said to deprive the easterly winds of moisture. The meteorological observations, though often affected by the *local* topography, have its results eliminated by computing the average direction from a number of stations within

a limited distance of each other. "By collecting all the reliable observations which have been made on the winds in the northern hemisphere, so far as accessible to the Smithsonian Institute, Prof. Coffin has established the fact that the resultant motion of the surface atmosphere between latitudes 32° and 58° in North America, is from the west; the belt being 20° wide, and the line of its greatest intensity in the latitude of about 45°. This however, must oscillate north and south at different seasons of the year with the varying declination of the sun. South of this belt, in Georgia, Louisiana &c., the country is influenced at certain periods of the year by the north-east trade-winds, and north of the same belt by the polar winds, which, on account of the rotation of the earth, tend to take a direction toward the west."

Mr. Russell, of Scotland, supposed all the atmospheric disturbances in this country resulted from the "unstable equilibrium occasioned by the superposition of the north-west wind on that of the south-west."

As to the Smithsonian Isothermal lines of temperature; (of which the annual mean for 50°, the mean of summer for 70°, and that of winter for 30°, are given herein on pages 144-5,); the mean annual for 40° commences near northern Nova Scotia, diverges gradually from parallel of latitude 45°, in its course through Canada and Lake Superior, till about the 95th meridian, it curves faster northward and leaves the United States for British America at about longitude 103°. The mean annual for 60° from near the mouth of Chesapeake Bay, passes a little downward toward the 35th parallel of latitude till about the meridian of 98°, then rises rapidly to the north to its greatest altitude at the 115th meridian, then gradually southward to the 125th, thence with a very short bend, goes parallel to the coast to latitude 34°. The mean annual for 70° passes from latitude 28° on the Florida coast, through New Orleans, to a point on the Pacific in latitude 30°. It

curves upward in passing through the gulf, showing that New Orleans is warmer than a corresponding place on the Atlantic or on the shores of Texas. It then curves rapidly north, showing the greatest temperature near the eastern edge of the mountain system. It ends on the Pacific, two degrees higher than where it began on the Atlantic. In all these descriptions it must be kept in mind that the temperatures shown are such as would be true were the whole reduced to the level of the ocean.

The summer line of 80° passes from Charleston S. C. rapidly upward through the valley of the Mississippi, showing a much higher summer heat in the interior on this parallel, than at the sea. The western part shows great summer heat in the mountain system, and great uniformity along the coast range parallel to the Pacific. The winter line for 40°, starting from the mouth of the Chesapeake, and following nearly the same general direction as that for 30°, meets the Pacific near Puget's Sound, giving this place, and Norfolk, on the Atlantic, about the same winter temperature. The winter lines for 50° and 60° are similar to the last, giving the Gulf less winter heat than the Atlantic and Pacific coasts. In reducing these lines to the level of the sea, 333 feet of elevation answer to each degree of Fahrenheit.

The great heat at the equator going down into the depths of the ocean, is supposed to expand its waters there, so that they stand higher than at the poles, occasioning warm surface currents from the equator towards the north and south, which are cooled, and eventually sink to the bottom, and then return, and so on. But as the earth turns on its axis eastwardly, the bottom currents flowing towards the equator from parts moving slower to parts moving faster, would fall behind into a westerly direction and ascend obliquely, and go back towards the pole, curving eastwardly. More or less of the upper current would keep on in an oblique northerly course

and now and then descend, some nearly reaching the poles. The four great ocean currents, of which there is one north and the other south of the equator, in the Atlantic and also in the Pacific, are thus partly accounted for; though Prof. Henry thinks them mainly due to the winds in the equatorial belts and the two temperate zones.

The Gulf Stream, passing from the equator along the Atlantic coast of the United States over towards that of northern Europe, warms up Great Britain and Norway into something very different from the climate of Labrador; and the Pacific current flowing along the Asiatic coast, probably does the same for Alaska, before it cools off, and returns by our western coast to be heated up again. It is on a similar principle that the trade winds and other currents of the great aerial ocean are formed; the rotation of the earth giving an oblique eastward direction to the heated and expanded equatorial airs, moving down inclined planes toward the poles; and an obliqne westward direction to the cold polar airs moving up inclined planes in the direction of the equator.

One of the most important subjects connected with climate, is the earth's radiation of heat. It is constantly receiving during the day, and giving out during the day and night. In the long days of summer it receives more than it gives off, and accumulates heat, so that instead of its beginning to grow colder as soon as the days begin to shorten, the effect of the previous heating continues till more is radiated than received, which occurs about the 25th of July, or later. But the radiated heat is less penetrating than the solar rays, and cannot readily pass through masses of vapor in the atmosphere; consequently in a humid climate like that of our narrow Pacific coast line, the temperature is remarkably equable throughout the year, and through five or six parallels of latitude. The haze from Lake Erie has some such influence in northern Ohio, not only in preventing frosts after cold nights,

but in arresting the effects of frost that has actually fallen. But to the great dry plains, the radiation brings cold nights after very hot days, sometimes making a difference of 60° in twenty-four hours between the high and low temperatures. Forests are supposed to do much towards preventing excessive radiation, although when they prevent the evaporation of standing water, they hinder the absorption of heat by the soil.

But deep culture, and especially subsoiling, make way for the reception and storing away of heat, and fall and winter crops growing, including grass, may greatly diminish radiation. Some have credited our Indian summers to radiation. One of the conditions of successful maize culture, healthful summers, admitting of timely and persevering field work, is promoted by the absorption through the vegetable world, of surplus heat.

What is called the belt of equally distributed rains in the United States, extends from 95° west longitude, to the Atlantic, between the 38th and 45th parallels of latitude, and here the prevailing winds are from the west. It is remarked of this "that the rain falls in frequent showers during the season, when the wants of vegetation require it." (See Ohio Agricultural Report, 1858.) Sometimes however, they come too heavily, as in 1857, when the continued warm rains in autumn, caused the rotting in the field of millions of bushels of corn, and the destruction of the germ next the cob in millions more, where the outer appearance was fair.

Farmers in search of locations in new districts, will do well to study carefully the meterological tables proper to them, that is, if the observations have been made extensively, repeatedly and carefully. Hasty conclusions from imperfect data are always unsafe. But knowing the latitude, longitude, elevation above the sea, character of surface, direction of the winds, and the relation of the place to river valleys, large

bodies of water and chains of mountains, the close observer will be apt to choose a location favorable to permanent success. But the extensive opening up of new farms, by subjecting the sod of centuries, covering large tracts, to decomposition, often fills the air with malaria, and makes them for the time being unhealthy. After this process of decomposition has become tolerably complete, salubrity will probably return, if other causes do not make the region permanently unhealthy.

As to the bearing of minor causes on maize culture, such as the aspect of a hill-side with regard to the sun and winds, earlier planting and earlier ripening often belong to locations sloping sunward, and perhaps more security against drought, to northern or north-eastern hillsides. When the cold winds come from the north-west, a slope towards the south-east is often a protection, unless the course of the wind is circuitous. The cold air often settles in deep valleys at night, while the neighboring hilltops are comparatively warm, which may be the result of greater radiation in the lower strata. It is likely to be otherwise when the valley is overhung with clouds or mists, which greatly diminish radiation. Moist winds often supply the needed fluids to the leaves of plants. But there is no end to the minor facts of an interesting character, arising out of climatic relations.

CHAPTER IX.

SOILS PROPER TO MAIZE CULTURE.

A first rate soil for the maize plant will have everything to supply or promote its growth, except what it derives from the sun, rain, dew, or atmosphere, or from cultivation.

The analyses in tables v, page 19, vi and vii, on pages 20

and 21, XLI, XLII, XLIII, XLIV on pages respectively 166, 169, and 170, and a few others herein, show the elements of maize. Some of the organic elements, the plant forms out of the materials presented or absorbed during growth, but the inorganic elements the soil must supply, or they must be otherwise obtained or added. Other materials the soil needs, such as *humus* to assist it in absorbing and retaining solar heat, moisture, and ammonia and other gases from the atmosphere. Some substances, such as lime, are needed as stimulants or chemical agents, for opening up the heavy parts of the soil, or compacting the very loose portions, or decomposing the vegetable waste matters. Other substances such as clay, (its base being alumina) mellowed by a suitable proportion of sand, are needed to give body to the soil, so that the plant can, by its roots, firmly establish itself therein. Waste animal and vegetable matters of a great many kinds may enter into the composition of a good soil for maize. Such a soil will be most surely found in river or creek bottoms. Water courses of all kinds, from the smallest rill to the grandest river, are manufacturers of soil. All bodies of water, from the little muck pond to the great ocean, do their part towards the building or repairing of soils. So also do the storms, floods, hurricanes, earthquakes and volcanoes. So also the frost, whether stealing over the landscape on still clear nights, or leaping down as glaciers, grinding the rocks to powder and crushing to atoms, in a moment, what man has been building up for centuries. So also the gentlest rays of the sun, and the quiet attractions and repulsions of inanimate nature, as well as the infinitely varied forms of life, contribute their mite toward the formation of soils. The more recent contributions of all these workers are most apt to be piled up along the banks of streams and around the mouths of great rivers. What the old-time workers have been doing in this line, if geologists speak true, may be seen in the dried up

beds of old lakes, as in north-western Ohio, and perhaps Indiana and Illinois. What a wealth of matter lies there, fitted for maize production, may be judged of from the effects of a dried up muck pond transferred to the corn-fields of a New Englander.

Corn on bottoms and fertile plains, however, is sometimes made under difficulties. The rains now and then come not to slake the natural thirst of the fields, but to drown the crop; and in other cases make their appearance just in time to stop the plough before the planting, or the cultivation after the corn is up. Even after a good crop is harvested and laid by, the results of too much of a good thing are sometimes what they were in Ohio in 1857.—It is then that the hillsides and rolling uplands come to the front. Here the soil is generally thinner, and the average yield smaller, unless high farming and gradually deepened plowing have carried the rich mould low enough for the best rooting of the plants. In the early settlement of the country, as a sage old farmer expressed it, it was of no use to say hills to the river bank farmers, even if fever and ague thinned out their numbers. But the German emigrants came in due time with their side-hill plows, and never tiring picks, to make our roughest acres glow with maize like the Peruvian mountain sides. And farmers that understand the use of muck and the art of mixing soils, find means to make the uplands hold on to their riches, and gain more.

From the exposed situation of high points, where plants will grow at all, the effects of the winters will be most severe; and considering the comparative thinness of the atmosphere, the thawing heats of summer will have a great effect in disintegrating rocks. When the elevated spot is comparatively level, the rocks will acquire a covering from the sand, clay &c., thus disintegrated, and as the nature of all cultivated soils, as shown by Prof. Way, and we may suppose, of all permeable soils resembling them, is to absorb free acids and

alkalies, and separate ammonia, potash and other bases from pre-existing compounds; we may infer that this disintegrated substance receives from the atmosphere more or less of those floating fertilizers, as well as seeds of grasses and other plants, and droppings of birds, and begins with very small growths, the refuse of which is left to decompose and produce more or less *humus*, and in the course of ages will accumulate considerable of a soil. Even on bare hill sides, more or less of the same process goes on. As the roots projecting from the crevices of the rocks, grow large and stout, their stumps arresting and giving body to the sliding matters from above, and these are gradually woven into grass plots or clumps of brushwood, warmed up by the sun, soils of very considerable fertility are often formed.

Prof. Newberry, the geologist, in his address before the Ohio Agricultural Convention in 1869, thus speaks of some of the Ohio coal measures, where stiff clay mingles with sand and limestone. "As the limestone and clay are impervious, in many instances covered with strata, through which the water runs down, until it reaches the impervious portions, and is distributed over the side of the hill, in never failing springs, so * * this regular distribution of moisture over the hillsides and surface, causes the decomposition of the rocks below, that constitute the soil. We get such a variety of desirable elements in the soil, among these hills in the coal regions, that exhibit unexceptionable fertility, with the best of corn growing on the tops of them."

"The coal measures cover about one-third of the eastern and southern borders of the State." The stiff, tenacious, intractable clays, grown over by the beech and maple, are found in "the upper coal measures, where the shale has been abraded." Shale or slate clay, differs from clay slate in being softer, with frequent impressions of fossil vegetables. Going northward from the coal measures, we reach the clay left by

the drift deposits, once considered intractable, and for a long time neglected; but after being subdued "give permanence and success to the efforts of the husbandman as much perhaps as any other;" the dairy farms of the Western Reserve being largely owned by highly prospered men.

In the north-western part of the State are the remains of the ancient lake beaches; sandy ridges with intervals of depression, once swamp lands, full of rich deposits, but requiring drainage. These show traces of ancient lake levels 25) feet higher than the present levels. In the south-west in the blue limestone region, is a continuation of the inexhaustable soil of the blue grass tract of Kentucky, underlaid by a vast mass of fossils, the disintegration of which has made the phosphates very abundant. In the south-west are also long tongues or islets, left by erosions, the work of ages. The Niagara islets, so called, form regular plateaus, generally holding the moisture which falls, and becoming in some instances intractable swamps, requiring thorough drainage before warmth and fertility can be established. The Clinton islets are warmer and more workable.—The varieties of soil, as set forth by some writers, are very numerous; Thaer and Fellenburg making 80. Judge Buel uses Sinclair's classification, including first, the sandy soil, where sand predominates; too loose to be retentive of manure and moisture.

It is the chief soil along the Atlantic from New York to Florida, and on the pine lands of the interior. If silex does not exceed 60 to 65 per cent, it bears working as well as other soils.

The proportion of seven-eighths sand, according to Sir H. Davy, is necessary to a sandy soil, and sandy or gravelly soils effervescing with acids, are called calcareous sands or gravels. To clay soils one-sixth, and to loams one-third of impalpable matter, not considerably effervescing with acids, is necessary. One half vegetable matter is required for peat.

As quartz and mica are in part constituents of granite, the soil abounding in their fragments, is called granitic. According to some writers, a proper sandy soil contains only 10 per cent of pure clay; a sandy loam, 60 to 90 per cent of sand; and from 30 to 60 per cent of sand can be mechanically washed out of a loam. From 15 to 30 per cent of fine sand, well mixed with clay soil, makes it *clay loam*, as it becomes more free and friable. From 5 to 15 per cent of silicious sand mixed with pure clay, makes the strongest (tile) clay soil. Pure or pipe clay, has 60 parts of silica, 40 of alumina and oxide of iron, in most cases chemically combined. Marls are an important element in eastern soils; they are differently classed by scientists, but those of the United States are divided by a writer in the U. S. P. O. Report, 1868, into argillaceous, glauconitic or green sand, and calcareous. Argillaceous marls consist of clay and sand with a little lime, and in some cases are valuable fertilizers. "Glauconitic marls include the green sands of New Jersey, Delaware, Maryland and a few localities further south," permanently beneficial for the potash and phosphoric acid they contain. "Calcareous marls are the debris of countless successive generations of life, the remains of which may or may not be recognizable, according to the amount of pulverization and attrition they have undergone, from the motion of the water in which they were deposited, and the subsequent conditions to which they have been exposed. These deposits range in time from the cretaceous epoch of geologists to the present era, and are even now in process of formation both in marine and inland waters. They are found in greatest amount in the tertiary strata." The limestone is supposed to have originated in the same way. Calcareous soils contain more than 20 per cent of lime, as classed by some; marls 5 to 20. Later authorities give certain marls from Vermont from 73 to 89 parts in 100 of carbonate of lime; and pond marl of New York, from 56⅕

to $93\frac{3}{4}$ of same, and other pond marls from $12\frac{3}{4}$ to $50\frac{4}{5}$ parts of lime; and shell marl from Maryland and the Carolinas, $21\frac{9}{10}$ to 90 parts in 100 of carbonate of lime. (See U. S. P. O. Report, 1868.) As distinguished from limestone, marls are generally friable.

Clay soils when thoroughly subdued by admixture of sand, barn-yard manure, lime or fertilizers, or by ploughing in green crops, or otherwise, produce abundant crops of sound corn. They are usually much more difficult to work than sandy soils, but are more retentive of moisture and ammonia, and probably better absorbents from air and water of fertilizing matters.

Much has been written on the analyses of soils; and there is no doubt they are of advantage in ascertaining some of the properties of a soil. The report of the chemist in U. S. Agricultural Report, 1871, maintains that it is difficult to analyze a soil, so as to give its average component elements. The ammonia contained is so volatile as to diminish one half or more in passing from spring to summer. The soluble salts of potash wash away. Still the farmer may profit by analysis, as it relates as much to the mechanical as the chemical composition. The relation of soil to heat is important. The power of the soil to absorb and retain moisture depends on the amount of water it can hold below saturation, and both of these can be detected by any one who has at command an accurate balance.

These properties, together with facility of percolation and the activity of capillary attraction, depend largely on the firmness of the particles composing the soil. The proportion of clay usually required as a measure of this in relation to water, is true only when the clay is not saturated with water. Sandy soils are very inferior to clay in absorbing ammonia. If manure added contains any lime, much more of it will be removed by a sandy than by a clay soil.

Prof. Voelcker showed that if the solution of saline matter brought in contact with a soil, be very dilute, there is hardly any absorption of ammonia, potash or phosphoric acid. This is spoken of as showing that the sewage of towns is of no value when very dilute, since the soil, though possessing highly absorbent powers, has not the power of overcoming the affinity of water for the solution.—One of the uses of calcareous marl is to increase the power of sandy or pure clay soils to absorb ammonia and potash. Carbonate of lime absorbs six times as much ammoniacal salt, as stiff clay. Gypsum in the soil helps to prevent the dispersion of ammonia.

These matters are said to descend during rain, or in winter, and rise during summer "when evaporation is greatest, and when the plant needs more food and moisture." (See U. S. Agricultural Report, 1870.)

Humus retains the moisture in the soil, and evolves heat by its slow decomposition. Its darker color makes it a remarkable absorbent of solar heat. Some extracts from Thaer's Principles of Agriculture in U. S. P. O. Report, 1844, as to the relations of humus, and sand and clay to the soil, are very much to the point. Abundance of humus gives a blackish hue to the soil. If a ball of earth is submitted to incandescence in an open crucible, which allows atmospheric air to come in contact with it, and its dark color is due to humus, it will soon disappear, and the earth become white. To find the quantity of humus in the soil, take a portion not too near the surface, and dry it in the sun till it pulverizes in the hand and feels quite dry; pick out the small stones, weigh the remainder accurately, place in a crucible heated to perfect incandescence, and keep it in that state for about ten minutes, and stir it with a glass tube all the time. To hasten the burning of the humus, a little nitrate of ammonia may be united with the earth, which completely volatilizes that substance. The diminished weight shows the quantity of humus.

The earth, especially if argillaceous, loses some of that water which was too closely united with it, to be evaporated only by the process of incandescence. Where the soil contains much lime, the volatilization of its carbonic acid and water of crystallization, will sensibly affect the result, and it is necessary to begin by getting rid of the lime. If a liquid paste is made of the earth to be analyzed, and water, and a strip of blue turnsole paper is dipped in it and turns red, it shows acidity in the humus. If the humus, when burning, smells like burnt feathers, it has come from animal matter, is richer, and more easily decomposed.

Clay makes land richer by the adhesion which it contracts with water. During a long drought, clay holds on to the humidity indispensable to the nourishment of plants, and yields it to them. It gives a solid support to the roots of plants, and by resisting their too great extension, obliges them to put forth "several tufts of short fibrous roots, by means of which each plant seeks its nourishment in a circumscribed spot," and does not rob its neighbors. Clay prevents the atmospheric air from coming in contact with the roots of those plants which it injures, and yields them a moderate and equable warmth during the constant changes of the atmosphere. If not too damp, growing crops on it suffer much less than those on sandy land, from sudden changes from hot to cold, and *vice versa*. Clay attracts oxygen, and probably nitrogen, and thus favors their reciprocal action. But excess of clay is injurious; in damp weather retaining its water too long and forming with it a tenacious paste. In dry weather it hardens, and often rubs against the plants like a mass of brick. During summer heat and winter frosts, it cracks into gaps or clefts, and tears the roots, or lays them bare to the atmospheric air. It forcibly takes up all the nutritive juices contained in the manure applied to it, and will not part with it as easily as lighter soils. Clay, thoroughly manured and in

good condition, retains its fertility a considerable time, but once exhausted, requires very heavy manuring to bring it up. A soil with too much clay is hard to cultivate; in damp weather clogging the plow and harrow, and in dry weather is hardly divisible into large clods, which refuse to crumble under the harrow or roller, until moistened by rain. A mixture of humus or lime ameliorates such soils more or less, but the application of sand is better. The upper layer always contains some sand, which makes it available for the plow.

Mr. Thaer makes the value of most lands depend principally on the proportions of clay and sand united in them. He means by sand, that coarse ground silica, which, when any portion of earth is carefully washed, is precipitated to the bottom of the vessel, and can be collected. Experiments had shown that when clay was boiled with water, a considerable quantity of fine ground silica was separated from it, and if this operation was prolonged and carefully perfected, the alumina was deprived of nearly the whole of its silica; the quantity of this fine silica being considered the difference between rich and poor clay.

Sand injures, when too large a component of the soil, because not sufficiently retentive of moisture, allowing the water to evaporate or drain away, and carry with it fertilizing particles and juices; and because it does not combine with humus, and hardly enters into a physical union with it, strong enough to absorb fertilizing particles from the atmosphere. Sandy soils will not bear frequent cultivation, though much is needed to destroy the weeds which infest them, especially where humus abounds; very frequent workings depriving it of that cohesion which prevents the wind from decomposing and carrying away its richer particles. Sandy soils, being good conductors of caloric, transmit the influences of severe cold or intense heat immediately to the plants, and at each sudden change which the temperature of the atmosphere un-

dergoes. A soil containing more than 60 to 80 parts in 100 of sand, is termed sandy clay. The value of this land diminishes in proportion as the sand increases. Mr. Thaer's classification of soils is very extensive and minute. Only a few of his distinctions have been here presented in a somewhat abbreviated form.

"Gravelly soils are sometimes composed of small soft stones, and sometimes flinty ones." "They often contain granite, limestone and other rocky substances, partially, but not very minutely decomposed. Gravel is more porous than even sand, and is *hungry*," especially when composed of hard and rounded substances; these do not attract the animal and vegetable matters they receive, and so easily lose them. When dry, these soils are soon heated by the sun, and cool more slowly than sand. Their crops are the earliest and most subject to drought. Indian corn suits them, especially on a sod of clover or grass ley. Gravelly loams, warm and dry, are especially advantageous in wet seasons and climates. Chalk soils have an excess of calcareous matter, which may be remedied by the addition of pure clay, and vegetable or animal matters, where these are deficient. Combined with sand or gravel, they are light and often unproductive.

The nature of the subsoil must also be considered. If the surface soil is easily penetrable, and the subsoil impervious and the land level, there is apt to be an excess of water about the roots of the plants, in moist weather. If both soil and subsoil are very penetrable, the water is apt to drain away too rapidly, unless there is an abundant supply of humus or a sufficient admixture of clay to hold a fair supply. When either the surface or subsoil is swampy, the excess of water leads to the formation of certain vegetable acids, which in excess render the soil cold and sour. Draining and subsoil ploughing do much towards remedying this.

The geological features of the United States show that lime

is the base of all the important fertilizers (except the green-sand marls,) which yield the most important inorganic elements to the growing maize plant. Limestone, or the natural stratified carbonate, magnesian limestone or dolomite, sulphate of lime or plaster, phosphate of lime, pond marl and other marls, are among the chief sources of these fertilizers. The older calcareous limestones of the Atlantic States form a wide belt nearly coinciding with the great eastern mountain range; beginning with the upper silurian limestone in New Brunswick, which appears in the Green mountains in connection with the lower silurian, it passes along the east line of New York, near the coast in northern New Jersey, through West Virginia, North Carolina and north Georgia, and ends in north Alabama. The newer calcareous deposits are divided among the more recent geological formations, the carboniferous, cretaceous and tertiary. The carboniferous limestone appears in Pennsylvania, west of the silurian and parallel to it, and shows traces along to the south-western limit of the silurian. The cretaceous appears in Georgia. The tertiary belt gradually widens from southern New Jersey to Florida, and is separated from the limestone range by gneiss, slates and sandstones. Large beds of shell marl and limestone formed from its consolidation are found in the tertiary. (See U. S. Agricultural Report, 1868.)

Great quantities of the phosphates are found in the Carolinas, and the green sands of New Jersey are celebrated as fertilizers. The Mammoth Cave in Kentucky, and similar ones but smaller, in north Alabama, middle and east Tennessee and Virginia, abound in nitrate of lime, from which saltpetre was made for gunpowder during recent war times.

Eminent writers have frequently characterized the great body of the far western formations as hopeless for extended systems of agriculture. There is considerable testimony on the other side of the question. The Reports of the Commis-

sioner of the General Land Office, (see the last named volume,) show not only in Iowa, Minnesota, Kansas and Nebraska, large tracts of river bottom, and rich upland suitable for maize culture, but also in Colorado, Dakota, Montana, Idaho, Nevada, New Mexico, California and Oregon, with irrigation, and in many districts without. Evidently the eastern system of agriculture must be more or less modified to meet the conditions found here. And when the successful methods have been found and reduced to practice, it does not follow that the extraordinary crops at first obtained in some cases, will be permanent. It would seem reasonable to suppose that in large rainless districts, uncultivated in the main for ages, there would be accumulations of fertilizing matters on the surface, the disintegrations of the rocks and the wastes of slender vegetations, and deposits from the atmosphere, comparatively unleached, and held together by a network of coarse grass, which when first made agriculturally productive, would bring forth for a time, wonderful crops. The first wheat crops in California were extraordinary, but the yield per acre is said to have fallen off greatly in recent years. Similar facts, though less remarkable, were true of much of the pioneer agriculture of the Ohio and Mississippi valleys. But, as the overflowings of the Nile were used by human skill and industry to make a magnificent garden out of a sandy desert, we may hope that science and skill will open new paths to high attainment in the arts of culture through this vast field for effort and enterprise.

What nature herself, without any aid from man, will sometimes temporarily accomplish for the renovation of land, is shown in the description given by the missionary Moffatt, of the great Karroo plain, in South Africa. During the dry season, it was perfectly devoid of vegetation, a solitary waste of indurated surface; but after the rainy season set in, it quickly revived, and in due time became an immense pano-

rama of wild flowers, a wilderness of beauty. When the dry season returned, the old desolation returned with it, to be again exchanged for the grandeur of loveliness, on the return of the clouds.

Some testimonies from the U. S. P. O. Reports, as to the adaptation of soil in the older States to maize culture, will now be given. In 1850, it was reported from Springfield, Vermont, that Indian corn on soil highly manured and well tilled, was the most profitable of all grain crops. In western Massachusetts, clay loam on a clay subsoil was said to predominate; there were also sand and gravel loams, and pure gravel and pure sand plains; and in Bristol County, (Southeast,) fifty to seventy five bushels to the acre of maize, were not uncommon. This crop, on the gravel and clay soils of Rhode Island, was made by the drought of 1849 a total failure. In average years it was good. Jefferson Co., N. Y., has well watered land; of a loose, gravelly or loamy texture, producing twenty-five to forty bushels to the acre, as a common yield. In Newcastle Co., Delaware, a heavy soil produces flint corn, and a light soil gourd seed. Cumberland Co., Virginia, in the old tobacco region, had been very much worn. In Buckingham Co., Va., the yield on uplands was about half that of bottoms. From Baldwin Co., Georgia, it was reported, (1849,) that the land would never be improved to much extent so long as cotton raising was continued. From Washington Co., Mississippi, that the pine woods farmers spoke of their sandy lands, little valued, as producing three fair crops of corn, and four or five of rice, with an occasional crop of sweet potatoes, before they were completely worn out. Manuring, except by cow-penning, was never practiced. Mississippi was said to have vast beds of rich marl. In Clark County, Ohio, (1849,) the uplands were said to produce the heaviest grain, and the bottoms the largest stalks and ears; average yield forty bushels to the acre.

Michigan soils required little draining, the surface being undulating; average of corn the same. Drains were being constructed in Indiana for reclaiming wet lands. In 1853, Berkshire Co., Mass., reported corn, with proper management, as fattening to the soil; the very process of raising a good crop was just what the land required at frequent intervals. The Shakers in Worcester Co., Mass., obtained from land naturally stiff and clayey, rather moist, suffering severely from drought, and somewhat rocky and unfeasible, maize crops of thirty-five to fifty bushels to the acre. The soil of Missouri was more favorable to this than to any other crop. Corn land in western New York was said to require more of the phosphates and vegetable mould than wheat, and was found in considerable quantities in the basin of Lake Ontario. From Ontario Co., it was reported that Indian corn was grown to advantage on a good, rich, gravelly or sandy soil. To raise it on a clayey soil was an up-hill business. The greatest difficulty was with the drought of July and August From Metagorda Co., Texas, corn was reported as growing indiscriminately, and in the greatest abundance, in every portion of the State, with less labor, and perhaps a more bountiful return than in any other part of the world.

As to the condition of the soil proper for maize culture, there seems to be no point on which the witnesses so generally agree, as that sod land, old pasture or meadow, of three or more years standing, other things being equal, is the very best. One of the largest recorded crops, made in the interior of Kentucky, some thirty-five years ago, of 196 bushels to the acre, was a result of a system of plowing in the fall before planting, a grass sod of eight years standing.

CHAPTER X.

IMPROVEMENT OF LAND FOR MAIZE CULTURE.

(*a.*)—Maize cannot thrive on land that has not in it the elements which the soil is expected to furnish. What these are, the analyses of the plant already given will approximately determine, if taken in connection with sufficient experience in culture. The enquiry will be more suitable under the name of fertilizers, reserved tor the next chapter.

(*b.*)—But these elements may be present without materially benefiting the plant. If this is due to the climate, and the temperature is at fault, the remedy if it is attainable, must be looked for in the choice of varieties, or special modes of culture. If due to deficiency or excess of moisture, as the prevailing character of a district, irrigation or drainage may make the crop feasible. In such cases these operations are apt to be made most beneficial, conducted on a large scale. But there are many cases, where the general climate is suited to maize culture, in which the season is sometimes unfavorable, and the location is so, as a rule. Certain spots are subject to early or late frosts, or to droughts or floods. They may wash badly, they may be covered with bogs or swamps, or they may be simply worn-out land. Land injured in any way by excess of water, requires a thorough drainage. If the soil is saturated with water, the sun in spring is too slow in warming it for timely plowing.

The result of Count Rumford's experiments as to the mode in which heat is propagated in fluids was, that heat is transmitted in water only by the motion of the particles in the water, and if the heated particles are prevented from rising, water cannot be warmed except where it touches the vessel containing it. To warm the water, heat applied to the sur-

face must be conducted downward by some other medium. Heat the bottom of a vessel, and the colder particles descend till the whole is warmed. Stagnant water will keep the soil cold from its want of circulation, and its removal is the first step towards giving the soil the benefit of the sun's heat. Where water only escapes from the surface by evaporation, it produces cold. Every gallon evaporated is said to carry off heat enough to raise five and a half gallons of water from the freezing to the boiling point. (See U. S. P. O. Report, 1856.)

Draining is said to raise the temperature of the soil often 15° Fahrenheit. Indian corn vegetates at about 55°, and at 45° the seed would rot in the ground without vegetating. The sun will often bring the temperature of dry soils up to 90° or 100°, when the air in the shade is only 60° or 70°.

There are different methods of reclaiming swamps and bogs after the surface water is drained. The eastern farmers make great use of the muck taken from them to aid in composting manure. The Shakers in Worcester Co., Mass., had some meadows which had been cropped of their natural grasses for fifty years, till no longer worth cutting, and then left to grow up to bushes three feet high, with moss and bogs. They were first ditched six feet to the bottom of the peat, the ditches near enough to each other for perfect draining. The bushes were then mowed, the bogs cut up and burnt, and the ground fall plowed, and planted according to their usual rotation. In 1853 they gathered eight hundred bushels of potatoes, "as fine as any one could wish" from four acres of such meadow, first plowed the fall previous, and each acre in the following June, after re-plowing, manured with ten loads of muck and planted, and then left to its fate till harvesting. They afterwards took a new plan to reclaim their meadows; first mowing the bushes close to the ground, bogs and all; leaving the surface clean and smooth, which was

burnt over and made an excellent manure. They next carted on fifty loads of clay loam and mixed the soils with a light harrow and sowed timothy and red top, which on the third year brought two and a half tons of hay per acre. Clay proved the best application on their meadows.

(*c*.)—Where the swampy districts are of large extent, the Government has sometimes taken their improvement in hand, and, as in Ohio nearly twenty years ago, devised a system of taxation for the purpose. North-western Ohio has had much of this character of soil. Eight hundred miles of drains of a more simple kind were reported to the Convention of Presidents of County Boards of Agriculture as having been laid in Wood County in 1857. They were ditches, into which were thrown long poles on which a light covering was cast. The work was greatly facilitated by opening the streams. The Convention however recommended tile draining as the best and cheapest mode. Of late years manufactories of drain tiles have been established in south-western Ohio, and much progress has been made in their use for underdraining. These tiles are "made of clay similar to brick clay, moulded by a machine into tubes, usually thirteen inches long, and burnt in a kiln or furnace to be about as hard as what are called hard-burnt bricks. They are of various forms and sizes. Some are round, with a sole or flat bottom moulded with the tile, and are called "sole tiles." * * Others are of a horse-shoe form, open at the bottom, to be laid on the hard bottom of the ditch without a sole, or in soft places with a sole or flat bottom of the same material, with the tile, made separate from it. For some localities, pipe tiles, merely round tubes, are preferred. When there is danger of displacement by reason of the soft condition of the ground at the bottom of the trenches, pipe tiles are often kept in position by means of collars of the same material as the tiles themselves, made loosely to fit over the joint. * * The size of the tiles to be

used varies from two to six inches calibre, according to the quantity of water to be conveyed. It is a question of expediency whether to use very large tiles, or to lay two or more courses of smaller size, side by side, when the flow of water is very great." (See U. S. P. O. Report, 1856.)

As for the depth and distance of the drains apart, there has been much controversy in England. Elkington introduced the deep draining system in 1764. His theory was that water from springs caused wetness in land. Mr. French of Exeter, New Hampshire, refers to the *thorough* drainage system of Mr. Smith (1832) of Scotland, as the one now generally adopted in Great Britain; its leading idea being that land is injured as often by water from rain which falls upon it, as from springs; and that all land may be drained by pipes laid at moderate depth, as three or four feet, at distances apart say from fifteen to sixty feet. In reference to this system Mr. French assumes that tiles must be laid below the reach of the subsoil plow, subsoiling to follow the work; they must be laid below frost and the roots of the crops; must have reference to the fall and outlet, and should be adjusted with reference to the cost; it being supposed to cost as much to dig the last foot of a four foot ditch, as the first three. Four feet depth in nine cases in ten, is best. The distance apart of the drains depends "on a careful study of the details of the subject," such as the nature of the soil, the disposition of the different strata of the subsoil, and the depth to which the drains are cut. Some stiff clays require three foot drains, fifteen feet apart; porous gravelly soils may admit drains of the same depth, sixty feet apart. As to the direction of drains over slopes, it is thought best, when running up and down the declivity.

The water enters the tiles both at the joints and through the pores of the burnt clay. It should enter at the bottom of the tiles. How it is that stiff, clayey soils, nearly imper-

vious to water in their natural state, can be under-drained is shown as follows: "All soils, and clay in particular, expand when wet, and contract when dry. When drains are laid in clay, the soil next the tiles is deprived of its water, and of course, rendered dryer than the rest. This causes it to crack, the cracks commencing at the drains, and extending in almost straight lines into the subsoil, making feeders leading to the tiles. The main fissures have numerous smaller ones diverging from them, so that the whole mass is divided up into the smallest portions. The dryer the soil, the larger and longer the main fissures. When wet comes, the cracks close up, leaving room for the water to pass through them. Clay, saturated with water, loses one-fifth in bulk on being perfectly dried."

The advantages of under-draining are both mechanical and chemical. Some of them have been already stated, and further, as applicable to uplands, as well as lowlands, it prevents drought, supplies oxygen to the roots, promotes absorption of fertilizing substances from the air, and improves the quality of the crops. The necessity for drainage depends mainly on the character of the subsoil. If this is of sand, gravel, or other porous earth, natural drainage carries off water not evaporated. A subsoil of such impervious substances as clay, or rock, chokes the passage of the water downward, and it becomes stagnant, or bursts out in springs. Land too wet in early spring, is often very hard in summer, so that cultivation is very difficult. It is often cold and sour; injurious quantities of vegetable acids are formed, and it suffers from early frosts in autumn. In a wet subsoil, the roots of the plants find unhealthy food in such acids formed in excess, and also in such inorganic substances as protoxide of iron. The advantage of under-draining in such cases is very clear. The Committee on draining, in their Report to the State Agricultural Society of New York, in 1848, asserted

that there was not one farmer out of seventy-five but needed draining to bring the soil into high cultivation. The Secretary of that Society, in his Report for 1855, said "the testimony of farmers in different sections of the State, is almost unanimous, that drained lands have suffered far less from drought than undrained." The general testimony shows that under-draining equalizes both temperature and moisture, for the benefit of growing plants. There is great gain also in the season for working the land being lengthened.

At a discussion on drainage referred to in the U. S. P. O. Report, 1868, a Mr. Brown remarked that drainage makes cold land warmer, wet land dryer, dry land wetter, heavy land lighter, and in some cases light land more compact; and that land thoroughly drained, if anything like hard land, could be cultivated at about half the cost of wet land.

Special directions for under-draining will be found in Prof. Norton's work on Agriculture. Mattice & Penfield's drain tile machine is described in the Ohio Agricultural Report for 1858. See also U. S. Agricultural Report, 1870, for exhaustive articles on draining.

(*d.*)—For dry climates and soils, *irrigation* has been practiced for thousands of years in some parts of the old world. Herodotus mentions a mode of raising water for irrigation, very much like the well-sweep and bucket formerly used in this country for raising water from wells. The Assyrians made canals for irrigation; the overflowings of their rivers not being rich enough. China and India, as well as Egypt, in very early times, made use of irrigation; so did the ancient Peruvians, and the Aztecs of Mexico. In Persia and Syria, and all the more Eastern Countries, it is still practiced; and it is an important feature in the agriculture of Belgium, France and Italy. A very learned treatise will be found on the subject in the U. S. P. O. Report for 1860, and others in the Reports for 1849, 1868, 1870 and 1871. Irrigation on

an extensive scale is comparatively a new thing in the United States. The necessities of the far west have called attention to the subject. Some account of what may be done in this way in the eastern States was given by Prof. Coleman some nine years ago in reference to a farm at Brattleboro, Vermont. The farm was on a high hill, near the summit of which a basin covers several acres, formerly a boggy swamp, and the source of a small stream watering the fields below. By damming up the lower edge of the swamp, a reservoir was made, holding a large quantity of water. From this, water could be taken over most of the farm, and carried to parts of adjoining farms. Irrigation was only practiced on the grass crop. The water, soon after leaving the reservoir was divided into several main channels by which it was carried to different fields, where it was made to flow in thin sheets over the grass. The water was let on in the spring before the snow was gone, the effect being the melting of the snow next the ground, a space being made between the snow and the grass. The water thawed the ground, and the heat thus given started the grass, so that by the time the fields were bare they became beautifully green. The water was kept running on the grass, not constantly on the same ground, but as required, until about two weeks before haying. Most of the irrigated land produced one and a half to two tons of hay the first cutting, with an after-growth of one-half to three-quarters of a ton.

In Colorado, (1871,) it was found that the co-operation of whole townships was wanted for success. In California the Pacific slope ditches were sometimes fifty miles long. The only water supplied to Denver for irrigation during eleven years, was by a ditch twenty-four miles long, and for building such a ditch by the combined work of farmers, very little cash was needed. Wells may be sunk on points too high to benefit by open ditches from a distance; the water being

raised by an ordinary suction pump put in and operated by a small windmill one can make himself. If the water is too low for a suction pump, a belt of cups may be used. But our space is too limited for even an outline of the practical methods, and other details of irrigation described in the volumes referred to. The time has not come in this country for its connection with the maize crop to be fully investigated.

(*e*.)—There are many other methods of improving land, some of which have been already referred to, such as plowing in green crops, clovering, liming, deep plowing, subsoiling &c., but most of them are intimately connected with the subjects of fertilization and plowing. In making new farms however, out of forest land, clearing the land for pasture is one of the methods of improving it, and when done well, is one of the best preparations for the maize crop. It is too common to be wasteful in disposing of the timber. Now that railroads are providing markets for lumber, and material used in laying tracks or making trestles, or manufacturing barrels, buckets and furniture, to say nothing about fire-wood, the young farmer on his eighty acres of new wood-land would do well to realize as much as possible from this source, before his acres come up to his requirements for general culture. Good fences are one of the great points in corn culture, and if he prefers board fences at the start, especially against high-roads, and his timber will admit of being worked up into lumber for these as well as for the out-buildings of the farm he is making, he may come sooner into permanent and substantial improvements.

Oak boards sixteen feet long, and eight to ten inches wide, when newly sawed and nailed with strong fence nails, so called, on nicely hewed or sawed locust or cedar posts, cut in July or August, and set top downwards, make a strong fence. A worm fence, for dividing the farm into separate fields, is very convenient and desirable, if made of rails ten

or eleven feet in uniform length, and of medium thickness, when the timber splits evenly and straight, and is fallen late in summer. It is usual to lay the corners of the worm on blocks or stones, to save the lowest rails from rotting next the ground. Very much of the strength of this fence depends on this blocking being of ample size, and evenly and firmly set. This fence is very commonly made eight rails high, and secured at the top either by locking or staking and ridering. Sometimes the riders are long poles. These methods are too commonly understood to need explanation here. For an outside fence of a maize field against a road much traveled, a well made *post and rail* fence, is probably the most secure. Locust is one of the best materials for posts, hewn straight and even, to about five inches thickness, except the lowermost two and a half feet, which enters the ground, and of sufficient width to make five or six mortises in a central line; in which the rails, usually split rather thin out of white oak, from six to eight inches wide, can be inserted. The ends of the rails are so trimmed, that when they are in position, with the bark side down, the lowermost rail of pannel No. 1 will have its end resting in the lower mortise fitted tightly with the end of the lowermost rail of pannel No. 2, and so to the topmost rails fitting in the upper mortise. The lower mortises are somewhat closer together than the upper ones, that the fence may keep out smaller animals. White oak posts are very common, but they are not so durable; and other evenly splitting timber may be used for rails, or narrow two inch plank. A great deal of such fence may be seen along the turnpike roads though the heavy maize growing districts of central Ohio, where the fields are of great extent.

It is usual to burn off the cleared fields before breaking up or turning into pasture. But if one can spare the capital to buy suitable stock for feeding, the leaves and decayed brush may help out his stores of manure. Forest leaves make ex-

cellent bedding for cattle, especially in winter. Cattle are great aids in subduing the young growths which spring up in a cleared field. For getting rid of stumps, very effective implements can now be obtained. If one makes a corn-field while the ground is full of roots, he will have hard plowing; but there are plows made expressly for the purpose, which are very nimble in jumping a root.

If one's eighty acres of new land be wet and level, it would doubtless be most conducive to health, as well as profit, to drain as fast as he clears. Under-draining may be more difficult when the ground is full of stumps and deep roots, but sufficient ditching to carry off the surface water is very important. In many level districts, the plow throws the field into ridges fifteen feet or less in width; with surface drains between. This was a common method in southern Michigan twenty-five years ago. If the eighty acres were on an extensive prairie, it would seem likely that there would be less danger of malaria from excessive decomposition, if only one-fourth were thoroughly broken up at first, and then highly cultivated. It might not be enough however, unless the limited breaking up were a general practice throughout a newly settled district.

(*f.*)—*Rotation of crops*, on judicious principles consistently followed up, is one of the chief helps to the improvement of land. Different crops remove different proportions of the elements of the maize plant, and it is apparent that for a series of years, other things being equal, the balance between these elements in the soil will be better preserved by a succession of different crops, than by a succession of maize crops alone. Rotation is of less importance in the case of river bottoms, where the occasional inundations bring on new supplies, or that of the hogging down system, which returns to the soil a large part of the elements taken from it during growth. One of the advantages of rotation is that it changes somewhat the

mode of culture, as well as the drafts on the elements. Fall sown wheat and grass help to preserve the soil from washing, and otherwise aid its mechanical condition. The potato root in decaying, lightens up the surface soil, clover roots, the deeper strata. Perpendicular rooted plants throw out few side roots, and derive most of their nourishment from a considerable depth, while fibrous rooted plants seek their food near the surface.

"The special insect enemies of the maize plant often lay their eggs in the soil, which has grown the crop they have been robbing, and a change of crop may leave them to starve. Maize being exhausting in the process of ripening the seed, and root crops removing less of the seed forming elements, a crop of roots intervening in the succession, will necessarily leave the soil supplied with these elements."

Maize is in some respects considered an ameliorating crop, though belonging to the culmiferous or robber class. The Scotch Rural Cyclopedia says of its culture, that when the manure adds as much fertility as the crop withdraws in the form of nitrogenous saline constituents of the grain and straw, it is powerfully ameliorating; its after culture working out the same results: it being an excellent correcting crop after turnips and potatoes, just in the degree that they are deeper and sharper and of more frequent action. In Italy it is known as a preparation crop for wheat, and can be so used in England.—Other works reckon the leguminous crops, as peas, beans, and other pulse, and also potatoes, turnips, carrots, beets, cabbages and clover, as ameliorating crops; because some of them are much less exhausting, from not generally maturing their seeds, and all of them less exhausting on account of their broad leaves, fitting them to receive nutriment from the atmosphere; and they divide up or loosen the soil by their tap or bulbous roots. They are now generally manured and cultivated during growth with hand hoes

or labor saving machines, and are well calculated to prepare ground for the small-grained and narrow-leafed culmiferous crops. One of the specialties of maize is that it is broad leaved as well as culmiferous, and can stand successive croppings better than wheat. But except where it is planted for the fodder, it is more exhausting than crops grown mainly for the roots, bulbs or leaves, as the potato, turnip, beet, clover, or hay crops; and of course becomes less so by alternating with them.

Clover, useful as it is for feeding cattle, is of more value for feeding other crops, and putting the soil in right condition for their growth. To a certain extent it is also valuable as a seed crop. The fodder plants, including the hay crops, support the cattle that furnish manure and muscular labor for the crops generally, as well as food for man.

The following principles, suggested by Chaptal are true in theory, but are subject to modifications in practice from varieties of climate and soil, and the special wants of localities.

A long series of crops will exhaust a soil, however well prepared. The extent to which every harvest impoverishes the soil is inversely as the nourishment it restores to it. Spindle roots ought to succeed superficial ones. We should avoid returning too soon to the cultivation of the same or similar growths in the same soil. Allowing two kinds of plants which admit of the heavy growth of weeds among them, to be raised in succession, is very unwise.

Those plants should be cultivated which restore most to the soil, where it shows symptoms of exhaustion from successive harvests. Clover is a very good substitute in a rotation for potatoes, carrots, and peas cut for fodder.

The following rotation is a choice one; corn, barley and clover, clover, clover, and wheat and one plowing. The increasing precariousness of winter wheat suggested the following: First, corn or potatoes with long or unfermented ma-

nure. Second, spring wheat with clover seed. Third, clover cut in June, and fallowed with turnips. Fourth, barley or oats, with grass seeds. Fifth, meadow. Sixth, pasture. Here are seven crops in six years, only two very exhausting, and three very ameliorating. Best where manure is scarce. The killing of weeds—the only good reason for a fallow—is done just as well by such fallow *crops* as require frequent weeding during growth.

But even a good rotation will wear out in time and need change. We can see in the forests and fields of nature's exclusive planting, how they tire of a long succession of the same growths, and have rotations of their own. Man has learned his from hers, and they underlie his best systems of culture.

The farm is supposed to be divided into three, four, five, six or more fields, the number of these divisions giving name to the course of crops assigned to it, as the three field system &c., or suggesting the three general ones of short, medium and long courses. But markets have much to do with rotations as well as climate and soil, and in view of North American peculiarities in these respects, New York was many years ago represented to the British agriculturists as usually following this course, first, maize ; second, wheat or rye ; third, flax or oats ; which was repeated as long as the land would bear anything ; it was then given a rest. The Dutchman's course on the Mohawk was successively wheat, peas, wheat, oats or flax, and Indian corn. In New Jersey, Pennsylvania, and Delaware, maize, wheat and rubbish pasture, or more lately, wheat, maize, wheat, clover and clover. On Virginia's best lands, maize and wheat alternately, till worn out ; but tobacco first, where that was cultivated ; and in east Virginia the worst results followed in impoverishment of the soil.

It is evident that the farmer should make his rotation as comprehensive as circumstances will admit. In the settle-

ment of new and fertile lands, especially if bought on credit, and the best market looks to some special product, he may be excused from practicing any settled course for a while. On thinner lands, an earlier attention to this is quite important, as it will take time to develope his best rotation.

Owners of hill-side or sloping farms, in these arrangements should have an eye to the best means to prevent their soils from washing Maize culture, here requires very careful management to be free from objection.

Among the more recent rotations in the United States, described in the U. S. P. O. Reports, as prevailing many years ago in Indiana, say in Wayne County, is successively clover, corn, oats, wheat and grass; Wabash Co., corn, wheat, clover, wheat, corn. Orange Co., corn, oats, wheat. Marion, same, ending with clover or grass to suit the soil. Bartholomew, corn, oats, wheat, clover. Greene, clover, wheat, corn, oats. Noble, wheat, corn, rye &c. Laporte, wheat, corn, oats, clover, rest two or three years, then wheat with clover, turn over sod and sow with wheat.

In Illinois, Putnam Co., two crops of corn, one wheat, one oats, one grass. Jackson Co., corn, oats, wheat, clover. Randolph Co., oats, wheat. In Michigan, Wayne Co., greensward, corn, wheat. Oakland, clover, corn, wheat, clover, wheat, corn. Hillsdale, wheat, corn, wheat. Monroe, wheat after barley. Washtenaw, wheat, summer fallow, wheat, oats, corn, clover with pasture. In Delaware the five field rotation prevailed, corn, oats, wheat, clover, pasture; varied more or less with the price of grain in the market. In Will Co., Illinois, wheat was grown among corn.

A Kentucky farmer bought a plantation which had been continued in corn twenty to twenty-five years, put it in timothy meadow adjoining a sheep pasture, and let a small flock of sheep run on it during winter, and manured it from the sheep fold, and kept it up in this way twelve to fifteen years,

during which it regained its original richness as the best of Kentucky land; raised several crops of tobacco on it, and again put it in meadow, with the above treatment. During the last thirty-four years preceding date, it had been in hemp; at last in corn, with an average product of seventy-seven bushels to the acre.

In Rappahannock Co., Virginia, in 1847, the five field system was in use; all the manure so put on, that three crops got the benefit of it; plaster sown on corn land, one gallon of clover seed, and one bushel of plaster to the acre sown with wheat; two years in clover, with plaster each year, last crop not good, but land left in good order to receive grass-seed. Another farmer represents the old wasteful methods continued for immediate market profits, and convenience in sowing wheat, but depreciates wheat after corn as bad farming, and gives his own rotation as maize, oats, wheat and clover; the clover being broken up for corn, and sheep fed on it in winter with preceding years fodder. In Delaware Co., Pennsylvania, the five field system; corn, oats, wheat, clover and pasture, though varied in 1848 more or less with the market prices of grain; three fields all the time in cultivation, corn, oats and wheat. In Madison Co., New York, corn on sward, barley or oats, wheat in the fall, in spring, clover and herds grass. In Sullivan Co., N. H., corn or potatoes on sward, a year or two more with these in small grains, then grass. At Lake Village, N. H., a rotation of thirty years standing was potatoes, corn, wheat, grass mowed six or seven years till "bound out"; but the last year before the report, corn was successfully planted the first year after breaking up. In 1870, some of the Virginia rotations were corn, tobacco, wheat and clover; corn, wheat or oats, clover or peas; tobacco or corn, wheat, clover or timothy, one year pasture; wheat on grass, corn, oats. In 1871, South Carolina land too wet for cotton, often produced corn.

The following rotation generally feasible and profitable; *cotton* signifying any cultivated or summer crop, as cotton, corn, sorghum, peas or potatoes; *grain* implies wheat, rye, oats or barley, and *clover* means any grass;

1st year, Cotton—grain—clover—stubble—stubble.
2d year, Grain—rest—clover—cotton—clover.
3d year, Rest—clover—clover—grain—cotton.
4th year, Clover—clover—cotton—rest—grain.
5th year, Clover—cotton—grain—clover—rest.

Wheat is recommended to follow corn in this rotation.

A few descriptions of rotations obtained from farmers in south-eastern Ohio in 1874, are as follows: *First*, on one of the oldest farms in the State, on the bottom of Muskingum river, near its mouth, soil a dark loam with some sand, occasionally overflowed; first crop corn on clover ground sown in the fall with rye, and pastured with sheep through March and April, then plowed and planted in corn, then another crop of corn, then wheat, with clover sowed in spring, then two years in meadow and pasture. *Second*, sandy soil on the plain above the former tract. First, potatoes; second, corn after two plowings; third, wheat; if not strong, sow clover; cut off the first crop of clover and turn the second down; then corn; if strong, corn again, if thin, wheat followed by clover. *Third*, Ohio river bottom land, originally very rich; has been long in cultivation. First, wheat sown in September on clover ground sown in the spring of the previous year; second, corn; third, oats; fourth, wheat; fifth, clover, mown in June, and second crop plowed in. *Fourth*, hill farm near the mouth of Little Hocking, clay soil. First, grass and grain, except corn, for four years; second, corn; third, wheat; fourth, oats, followed by grass about four years. *Fifth*, rolling upland, clay soil. First, grass four years or more; when this begins to run out, plant corn, then oats, then wheat. Several farmers in south-eastern Ohio describe their rotations as

corn, wheat and grass in succession. To carry out a regular system of farm improvement, the cultivator should observe closely, and think for himself. It is of great advantage, when it can be kept up regularly, to have an agricultural diary, wherein he can jot down the results of his observations, the details of his experiments, and interesting incidents connected with his successive croppings.

A large amount of statistics connected with agricultural matters are now being accumulated in public journals and documents, which with their relations to the events and facts of the respective times to which they belong, should be carefully studied. Nothing helps progress more than the habit of looking through things, if the results of this insight are turned to a good practical purpose.

CHAPTER XI.

ENEMIES TO MAIZE CULTURE.

Under this head some reference will be made to those quadrupeds, birds and insects, which are injurious to the maize growing farmer. Ill fed domestic animals sometimes are, where fences are bad. Much interesting matter on this subject will be found in the U. S. P. O. Reports, and the Agricultural Department's annual and monthly Reports. An entomologist has been connected with it, whose descriptions of the nature and habits of destructive insects, from year to year, have been learned and comprehensive.

A full description of the beetle tribe is given in the Report for 1868.—Mr. Robert Kennicott, in that for 1856, fills more than fifty pages with a treatise on the quadrupeds of Illinois, injurious or beneficial to the farmer, which is followed by a scientific description of the birds injurious to agriculture, by

Dr. Ezekiel Holmes, of Maine. Both these are largely illustrated by plates. Among the former are described the various families of squirrels, the prairie dog, the ground hog or woodchuck, meadow mouse, the white-footed wood and prairie mice, the long-tailed jumping mouse, the prairie meadow mouse, the wood meadow mouse, the long-haired meadow mouse, the muskrat (which is said to be seldom seriously injurious,) the common house mouse, and the brown and black rats.

Among the birds described are the buzzards (red-tailed, Harlan's, and broad-winged,) the bald eagle, the red-winged starling (or corn-eater,) the orchard oriole, which devours some fruit, but helps the farmer by making away with pernicious insects; the crow blackbird, which feeds on worms and grain and small crabs; the purple grackle, another crow blackbird, which sometimes pulls up seed corn. Louisiana planters sometimes steep their seed corn in a solution of glauber's salts to prevent its ravages. The common crow is a very skillful robber of sprouting corn, but as he is also an enemy of snakes, frogs, lizards, grubs, insects and various species of worms, and protects the farm-yard poultry from the hawk, he is considered by some to be more of a friend than an enemy. The common magpie eats worms, but sometimes grain. The blue-jay is a great corn thief. The great American shrike devours caterpillars, insects and small birds, and is sometimes called the butcher bird. The wood-pecker eats corn, fruits and insects, (both the red-headed and golden-winged wood-peckers.) The Carolina parrot is chiefly a resident of the south, but sometimes visits the lakes, and is a great pest to the farmer, destroying stacks of grain or the shocks standing in the field. "Hundreds are often slain by the side of a single stack, which they had covered so densely as to appear like a vast green carpet spread over it." The passenger pigeon has a wide range, but is rarely met with except

in vast flocks in immense forests, the trees being crushed or blighted by their weight. Mr. Andubon once tried to count the flocks on the wing passing above him, and in a short time numbered 163, but could not keep the count, and desisted. He said the light of noonday was obscured by them in flying, as by an eclipse. They have the wings and eyes to search out the needed food through a very wide range in a very short time; and at once descend near the earth when passing over an inviting field; and forced by hunger, alight and skim over the fallen forest leaves for mast; stripping vast tracts of every atom of food. The whooping crane ranges from the Arctic regions to Texas, feeding on the rank herbage of swamps, especially the roots of the great water-lily, and when this fails, on corn, peas &c., water insects in wet fields, toads and frogs.

A few pages in the U. S. P. O. Report, 1853, are given to notices of the friendly acts of these quadrupeds and birds. The striped gopher or spermophile of Wisconsin, eats some corn and other grain, but prefers grasshoppers and mice, and keeps in check other destructive small quadrupeds. The importation of skylarks is recommended for their song and their raids on insects. Hawks and owls are thought to be the only birds really injurious to agriculture, as destroying poultry and small useful birds; crows and blackbirds doing more good in devouring worms than harm in pulling up corn. It is suggested that a boy be paid a small sum for watching the fields one or two weeks till the corn gets too strong for these depredations, and for the rest of the season the birds will work gratis in ridding the premises of mice, worms and snails. Some farmers at corn planting, scatter a bushel or so of shelled corn over the field, which the birds will probably pick up with the worms, and let the planted grain alone.

It has been said that the statistical reports of Europe seldom mention a failure of crops from locusts, grasshoppers,

curculio, grub-worm, Hessian fly or weevil; these being kept in check by armies of birds.

M de Tschudi however, in an extended article on destructive insects and the utility of birds, a translation of which is found in the Ohio Agricultural Report for 1862, states that though the birds of northern Europe, in the winter when the insect world is asleep, visit the south to reproduce and feed on the larvae, eggs and nests of insects, flies, spiders and bark-eaters, their numbers seem insufficient; as complaints come from Germany and Switzerland of green meadows, vegetable gardens, and crops of wheat and flax being laid waste by the sudden influx of insects; the cockchafer being the greatest foe among the beetles; and of inferior insects, flies, gad-flies, wasps, worms and snails being too well known as plagues. This is charged to the increasing diminution of birds, consequent on progressive cultivation, accompanied with the cutting away of thickets, large trees and extensive woodlands. Old trees full of small holes, the resting places of the insectivora, had been cut down right and left. The rage of the Italians for killing small birds is also referred to as a cause of their diminished army; the little insectivora, including the nightingale, being slaughtered by the million in mere sport. The titmouse, wren, swallow and martin, the chaffinch, jay and jackdaw, are mentioned as very effective in the war on destructive insects. The cuckoo is a great eater of caterpillars. Some comments followed M de Tschudi's article, applying his remarks to the birds of Ohio: Birds of prey belonged to the first class, the insectivora to the second, fruit, grain and insect eaters to the third, and birds eating vegetables only, to the fourth. Of the second the woodpecker, humming-bird, whippoorwill, night-hawk, fly-catcher, thrush, warbler, mocking and cat bird, creeper and nuthatch are added to those already enumerated herein. Of the third class are mentioned the cedar bird and

wax-wing, the shore lark, the whole family of Fringillidæ, including the grosbeaks, finches, yellow-bird, crossbills, sparrows, buntings, indigo-bird, red-bird and ground robin, the family Icteridœ, which includes the bobolink, cow black-bird, &c., the Coroidæ, (raven, crow &c.) ; the wild turkey, prairie hen, pheasant and common quail. In the fourth class are the Carolina parrot, wild pigeon, dove and goose.

Prof. Jenks being requested in 1858 by the Massachusetts Horticultural Society to report on the habits of the robin, stated as results of his observations that the gizzards of those killed in the morning were, as a rule, either entirely empty, or but partially distended "with food *well macerated*; while those killed in the latter part of the day were as uniformly filled with food freshly taken. * * From the almost daily examination of their gizzards, from the early part of March to the first of May, not a particle of vegetable matter was found in the gizzard of a single bird. On the contrary, insects in great variety, both as to number and kind, as well as in every variety of condition as to growth and development, were the sole food. But nine-tenths of the aggregate mass of food thus collected during this period, consisted of *one* kind of larva."

Descriptions of the rapacious birds of Ohio are given in the Ohio Agricultural Report for 1858, by Mr. John Kirkpatrick. Immense flocks of birds sometimes gather in the suburbs of the smaller cities, and demolish small corn patches in a few hours. Moles, by many farmers, are considered great pests, as rooting up the soil where young plants are growing, and in some cases corn has been found in their stomachs; but probably in their underground movements, they are more in search of the wire-worm and other destructive vermin, of which they are said to devour immense numbers. The larvæ of the May beetle eat into the roots of grain, and in turn are eaten, when they become perfect beetles,

greedily by the crow, jay, night-hawk, whippoorwill and domestic poultry ; and hogs, weasels, rats, moles and field mice are also their enemies.

One writer states that breaking ground in warm weather, when the grubs are not deep enough under the surface, is the best means of destroying the larvæ of the allied species found in Europe. A patch overrun with grubs is best in hog pasture. (Dr. Fitch.)

The worms found in flour and meal are said to be the larvæ of a blackish brown colored beetle, and are much used in Germany by bird fanciers. They may be separated from the meal or flour by sifting through a fine sieve.

The *corn emperor* moth feeds on the blade of Indian corn, is two and one-fourth to two and three-fourths inches long; the sexes differing in color and size. For a particular description see the U. S. P. O. Reports. The wire-worms feed on roots of plants. Soot and lime, chloride of lime, or nitrate of soda will destroy them; also spirits of tar and sand, or lime from the gas works. (See U. S. Agricultural Report, 1863.) Corn cobs have been recommended with the idea that the worms would burrow into the cobs and leave the crop unmolested. Fall plowing is said to bring grubs to the surface where they will be devoured by birds and small animals. Some English writers recommend sliced potatoes or turnips, strewed along the rows as bait for the wire-worms; the slices being examined every morning.

The New England Farmer (vol. VII,) contains a method of avoiding the ravages of the weevil tried by James Carroll in 1827. A corn house was built with a door at each end, and in October the ears were pulled with the husks on and deposited therein, except on damp mornings. When husked two or three weeks after, they were found to have kept admirably; the only grains eaten by the fly being at the ends of ears not covered entirely with the husk. A very fine ear

of the same crop was husked from the shock and laid away in a closet for a year, and when taken out was found completely honeycombed by the fly.

J. H. Dent of Barbour Co., Alabama, in 1849 wrote to the U. S. P. O. that the yellow corn was not so liable as the white to rot in the field, or so subject to the ravages of the weevil, which had lately been very destructive of the corn. It had been housed in the shuck, and in one or two instances salt water was sprinkled on each load as a protection, but without beneficial results.

The *chinch bug* in Iowa, (1848,) was described as a small insect resembling a gnat; began on young corn in the spring, but if not numerous, did little damage. In 1870 it was very destructive there and in Kansas, and other north-western States. They commenced in a corn-field on one side, and went through from row to row. In one case they were effectually stopped by taking a pail of water, with half a gallon of salt well stirred in it, and with a small broom or brush of feathers, sprinkling a row of corn just ahead of the bugs; taking care that the ground between the hills was well sprinkled with the brine.

The monthly Report of the U. S. Agricultural Department for August and September 1876, gives their scientific name as *Micropus* (*Rhyparochromus leucopterus*.) and says they showed themselves during August on the Atlantic slope, "having been noted at several points in the Mississippi valley during July. Davidson and Warren Counties, North Carolina, were troubled by them. In the latter, strong ley of wood ashes applied to the cornstalk disposed of the pests. It was found necessary however, not to allow the ley to come in contact with the corn bud, as it would probably destroy it." They threatened the corn in Boone and Winnebago Counties, Illinois. In parts of Wisconsin, they attacked the corn after destroying the wheat, stripping the corn blades when the grain was too hard for them.

The boll-worm, or corn worm (*Heliothis armigera,*) in 1854, injured corn and cotton very much. It eats the growing grain in the husk. As a remedy, fires are made near the corn patch in the evening to attract the moths, destroying them before their eggs are laid. (U. S. P. O. Report, 1871.) In 1876 they were reported in parts of Mississippi and Texas.

The black *curculio* with its curiously wrought thorax, in 1870 was very destructive to the young plants of maize fields in New Jersey, piercing the stems on which the larva lives.

Dr. Walsh speaks of a similar insect as piercing corn blades with six or eight holes of the size of a pin or larger, and where these pests abound, every stalk is killed.

The ravages of the *grasshopper* have already been referred to. They are among the *Orthoptera,* which includes also crickets, cockroaches &c., and are provided with jaws, the upper wings thick and opaque, while the large under ones are net veined, and fold like a fan. The transformations are partial, the larva and pupæ resembling the perfect insect, but wanting wings. (See the U. S. Agricultural Report for 1868, which gives practical directions for farmer's sons to pursue the study of entomology.)

A very full account of the grasshopper nuisance is given in the monthly U. S. Agricultural Reports for May and June 1876, and also for August and September. During the week ending August 1st, at Bartow Co., Georgia, they appeared in alarming numbers. One corn-field of twelve acres had not a blade of fodder left on it, and many of the young ears were destroyed. In Carroll Co., a very destructive kind never before seen, had made its appearance. They may have been the *Caloptenus differentialis.* They were of various colors, green, yellow and striped, and they had put in an appearance in seven other counties. The caloptenus spretus were destroying the crops and depositing their eggs in Minnesota;

they had ruined thousands of acres of grain in Iowa, and the entire grain crop of Montana, and all the corn crop of Dakota; were doing more or less damage in New Mexico, and Colorado, and caused great destruction in parts of Kansas and Nebraska. In Minnesota they deposited their eggs in the fall, which were hatched in the following spring, or early summer. In the north-western States the grasshoppers are identified with the *Caloptenus spretus*, which visits only regions west of the 17th meridian. At Osage, Nebraska, the incubation of these eggs in a field of oat stubble having been carefully noted, the average number of deposits to the square inch was estimated at fifteen; reckoning thirty eggs to each deposit, the number infesting one acre would be immense.

The *C. femur rubrum*, is the scientific name given to some grasshoppers damaging the corn crops in Pennsylvania and Tennessee; they chewed tobacco in Virginia and Kentucky.

The *heteroptera*, including the plant-louse &c., feed on the juice of growing plants. In the U. S. P. O. Report, 1868, is given Prof. Glover's report on the food and habits of beetles (*Coleoptera*.) The American works he refers to are those of Dr. Leconte, Say, Harris, Fitch and the American Entomologist. Dr. Leconte's classification (the first part only, being then published,) reaches forty-five families of beetles. The second family, *Carabidæ*, or ground beetles, vary greatly in size, form and color; are of so firm a make as to creep under stones, bark &c. Most of the species are very insectivorous.

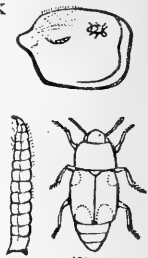

(1)

The larva of our native *Omophron labiatum*, (1) a small beetle of black color, bordered with brownish yellow, is said to be very destructive to young maize in the southern States. The fifteenth family *Nitidulidæ*, are usually small beetles of an oval, or depressed, or slightly convex form, sometimes almost globular or elongated. They live on decomposing substances, both animal and vegetable. The

second tribe of this family, *Carpophilini*, are usually flattened in form, and have the last two or three dorsal segments of the abdomen uncovered by the somewhat short wing cases; as the


(2)

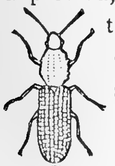
Colastus semitectus, (2) in the decayed ears of maize in the field, where they probably form minute fungi. *Carpophilus hemipterus*, (3) a brownish black beetle, having four light spots on its short wing covers, is also found in similar situations. The insects of tribe three of the same family, *Nitidulini*, are mostly small, with bodies oval, subdepressed, thorax margined, and their bodies covered with wing cases.


(3)

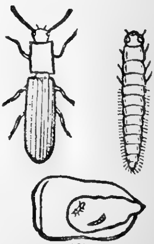

(4)

Ips quadrisignatus, (4) a small black beetle with four yellow spots or marks on the wing covers, is said to burrow into sweet corn.

Of the seventeenth family, *Trogositidæ*, insects having the body more or less depressed, with short club shaped antennæ, the *Trogosita dubia* eats maize, beech nuts &c. Of the twentieth family *Cucujidæ*, (small insects almost always of a depressed, and usually of an elongated form,) a species,


(5)

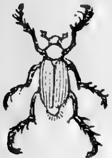
the *Sylvanus Surinamensis* (5) is a very minute beetle of a chestnut brown, and having several teeth or spines on the outer edge of the thorax; is found in wheat and maize.


(6)

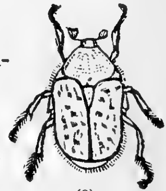
Sylvanus quadricollis (6) resembles the others in general appearance; but has a quadrate or four-square thorax. The egg is laid near the germ, in maize; the larva feeds on the substance of the grain.

The thirty-second family contains insects, the hind legs of which are placed so near the extremity of the body as to give the beetle a most extraordinary appearance while walking, and is called *Scaraboeidae* after the *Scaraboeus*, the sacred beetle of the

Egyptians. A sub-family *Melolonthidoe,* feed wholly on vegetable matter.


(7)

It includes the rose bug, *Macrodactylus subspinosus*; (7) the perfect beetle appearing in May and June, on roses and other flowers, and maize does not escape its attacks.


(8)

The *Euryomia (Erirhipis) Inda,* (8) is a very common beetle of a brown color, checkered or mottled with a darker tint, which feeds on the sap of maize and cotton bolls.

The *wire worm* has been for a long time a pest to corn fields. It has been described as a yellow, hard worm, about one inch long, and of the size of a knitting-needle. It works itself into the heart of the corn before it is up, and afterwards around the roots, keeping back the growth of the plant. It was very destructive in some parts of Maryland in 1847. An Ontario Co., N. Y., farmer wrote to the U. S. P. O. in 1853, that fall plowing generally prevented its ravages.

A Berkshire Co., Mass., farmer, (1853) in reference to worms generally, wrote that fall plowing did not prevent them; he had seen cases the previous season, of fall plowed fields where their ravages were horrible, while in others of similar soil, plowed in spring, no bad effects were visible.

The *cut-worm* is said to be more injurious in spring. Many years ago, in some situations, it was thought to cease its ravages before late corn planting. A Bradford Co., Pa., farmer, in 1853, stated that some planted their corn about June 1st, to escape it. Mr. Klippart, in the Ohio Agricultural Report, 1858, said the only way to get rid of these pests in greensward corn-fields, was to kill them outright in their hiding places, with sharp sticks, early in the morning; but they could be prevented by plowing the sward in August of the previous year. It was also stated by an eastern farmer, that fall or

winter plowing was the only chance to escape them. The crow is said to eat them. Many farmers say that the young corn destroyed by these birds had almost invariably a cut-worm or insect preying on its roots. Others think the crows do more harm than good.

It has been advised by some to soak the seed corn in copperas water, or a solution of copperas and saltpetre, tar it and roll in lime, as a preventative to the cut-worm and most other devourers—but the *grub worm* was excepted out. This was worst in summer.

A Niagara Co., N. Y., farmer, (1853) wrote that the most successful tillage had been found to be plowing a highly manured clover ley in the fall, that the frost might destroy the grub-worm. Another from Troy, N. Y., that sod plowing in the fall was more apt to kill it than spring plowing.

It seems probable, from the report of the entomologist for 1866, that the large white grub worm so destructive to corn crops in some parts of Michigan, was the larva of a beetle, the May bug. A Virginia farmer gave as a reason for leaving only one or two stalks in the hill, that birds and insects attacking a hill of a dozen stalks generally destroyed all; but he generally destroyed the worms by grazing the land intended for corn, during the previous fall.

The larvæ of some beetles feed on the *army worm,* which has infested certain eastern corn-fields. The *hunter weevil* was an eater of corn leaves, and the larva of a similar insect in South Carolina so fed on the corn-stalk, as to destroy the plant; the only known remedy then being hand picking and burning of the infested plant. At Washington, Miss., in 1849, it was found necessary to plant hard ,flinty corn to head the weevil, with which not only the cribs, but the heads of corn in the field were infested. This was known as the "black weevil," or true rice weevil, distinguished from the European by two reddish spots on each wing cover. D. L. White of

Gadsden Co., Fla., in storing his corn, threw a quantity of the berries and leaves of the China tree into each load, as it was deposited in his corn house; having from several years experience found it a good preventative of weevil and rats.

It is very important to destroy parent insects before they have time to deposit their eggs. For one in April, there are thousands in autumn.

Some of the beetle tribe are beneficial. The first family includes the tiger beetles, which in both the larva and perfect state destroy all the insects they can. Of the second family, the *Calosoma Calidum* is very common in Maryland and Virginia, and the larva was caught eating the caterpillars of the common army worm; great numbers of the larvæ were seen destroying all that crossed their path. Some became so bloated with this food as to be unable to move, and became the prey of their lean and nimble brethren.

Dr. Fitch, in his report on the injurious insects of New York, in 1856, says that in Europe insects most destructive to grain are so preyed upon by their internal parasites, as to be entirely harmless, and recommends the importation of these parasites to keep down the grain pests. Every insect is thought to have an insect enemy; and when these last are destroyed, the first riot in destruction.

Wilson's Cyclopedia recommends as against the wire-worm the sprinkling of hot lime from a bag, after dark or immediately after a rain.

A species of uredo is referred to as a parasite on the flower of maize. The ovules of the *phaloena forficalis* are sometimes deposited in the culms, and their larvæ in feeding, enfeeble or destroy the spikes.

The grub-worm has been spoken of as one of the most destructive insects in the United States. A Jay County Indianian, (Cincinnati Weekly Gazette, 1873,) describes its ravages as far exceeding those of the cut-worm, because ex-

tending beyond the season of repair by re-planting; its coiling around the main root cuts off light and heat from above and moisture from below. In a field of Indian corn infested by him, this being his especial delight, many hills are seen behind their fellows in growth, though not deficient in color; the leaves being erect and pointed, sometimes tinged with red, dark or pale green; and the plants do not mature, but struggle on uselessly while the grub gnaws their vitals.

Another Indianian in ditching in the fall a corn-field where the grubs had been very bad for the two previous years, and especially the first year, at the depth of eighteen inches dug up the shell or skin of the grub-worm; close to it was a June bug, and further on was one partly out; this was supposed to lay the egg from which the grub is hatched. The worm is small when it first appears, and only works on the corn two years; in the first all the year, in the next only till June; and the following year the bugs come. A Wayne County Indianian found manure freely applied to corn ground a good remedy against grubs; throwing it out of the stables into a wagon and going right to the field with it. A Highland County Ohioan in 1872, had found from three years experience, that this worm did not injure his corn when he hauled on horse manure from his stable as it accumulated.

The importance of the study of entomology to the farmer is apparent from the above statements. Insects are to a large extent gleaners of vegetable and animal matter going to waste, or scavengers of unhealthy or dead matters, and naturally prefer such. If this supply fails, they may devour one another, or healthy and firm growths, such as maize; though much depends on the habits of the special insect. If the parasite does not destroy the insects in sufficient numbers to keep them in check, there are the birds, which from the necessities of their intensely active nature, generally prefer animal food, to do this as effectually; and if insect food fails,

the birds that feed on them attack the grain. The bat is also insectiverous.

Certain small quadrupeds that infest maize fields and granaries, as mice and rats, we have seen, find enemies in the weasel, cat, dog and the larger birds—not excepting the owl. The rabbit and hare, which might be great maize eaters, are too highly prized as game to be troublesome on a large scale, unless in a newly settled country. One hare has been known however, to tip off in one night forty or fifty rods of a row of corn.

It is very necessary to put all these facts together, to see why apparently there should be contradictory statements as to certain prescribed remedies.

Some of the diseases of the maize plant mentioned as prevailing in Mexico are *La raquitte*, a kind of wasting consumption, where the plant is grown on barren soil, and soon after planting is exposed to moist, cold weather. *El carbon*, a vegetable carbonaceous growth in the ears, or one which makes the buds abortive. *El hango* forms itself in the ear and destroys it.

Others are mentioned in the U. S. P. O. Report, (1847;) one as prevailing in Maryland, attributed to drought in the early part of the season, and the rains which succeeded in August. Dr. Muse describes the cap of the injured ear as discolored; and when opened, a few grains near the apex of the ear, and one side of it mark the commencement of the disease, appearing sickly and shrivelled. This increases in space and intensity till the whole ear is a black rotten mass, while the parent stem has a healthful and vigorous appearance. Solar influence is probably wanting to aid the vitality of the plant in the elaboration of juices—to decompose the carbonic acid; fix its carbon, and restore to the atmosphere its oxygen.

Smut in corn is a common disease. Probably the best thing

that can be done to prevent it is to spread the manure supplied from the barn-yard carefully, and put in the hills only well rotted manure, and watch the field about earing time and remove the ears inclined to this disease as fast as they appear. A correspondent of the New England Farmer in Vol. VII, thinks the cause is the exuberance of the fluid that forms the kernel; that "the vessels are surcharged, and burst before the aliment can be fully concocted and disposed of." He had cultivated a field eight years before, and obtained the premium. To a liberal supply of strong manure, he added the usual quantity to the hill; the season was very favorable, growth rapid and vigorous, the stalk large, and prolific in suckers. As the ear formed, the smut appeared; he did not dislodge it until it burst; fifty wheel-barrow loads of it to the acre were consigned to his hog pen. Still his field produced the largest crop of corn he ever raised. He grew corn in the same field the season of his writing the above, with no variation except in dressing. His coarse stable manure was spread and plowed in as before, the hills manured from compost made the previous year in his yard, carted in autumn and thrown into large heaps and covered from the weather. The season was equally favorable, and the product nearly the same, and not the fiftieth part of the loss by smut; what there was was severed, but there was too little of it to be worth taking to the hog pen; the suckers also were too few to do any harm. The lessening of the smut seems to have been due to the quality of the manure put in the hill.

To prevent shelled corn from becoming musty, it should be carefully shielded from damp; should be spread on a floor to dry not over sixteen or eighteen inches in depth, and frequently turned, and if still inclined to be damp, should be kiln dried. But corn is best saved in the ear.

A more thorough system of draining, carried out on a widely extended scale, may greatly diminish the diseases to

which the maize plant is subject, and improvements in modes of cultivation and in farm building, may lessen them much more; and immunity from disease might be a great protection against its other enemies. How far the grasshopper plague is connected with the vast scale on which the Great West has been suddenly opened up by the plow, or how far it is the result of the destruction of natural enemies, are subjects which may perhaps be better understood when the mountain regions are more compactly settled.

CHAPTER XII.

LARGE CROPS OF MAIZE PER ACRE.

Large crops are valuable as showing what can be done on the richest soils, in the most favorable seasons, and with high culture. A general average of good crops is of more importance to the country than a few extraordinary ones where the average is very low. They are most valuable where they indicate the use of the best fertilizers and the best modes of cultivation capable of being generally adopted. Those to which reference is made herein will be chiefly those noticed in the Reports issued by the U. S. Government, or the State of Ohio.

(*a.*)—One of the largest general crops of maize was raised in Jessamine Co., Kentucky, a very rich agricultural district, and was referred to at the close of chapter IX, herein. It was a premium crop; five acres being measured by a committee of the Agricultural Society of that County, and the whole crop pronounced the same average. A full account of the mode of culture was given in the Louisville Journal at the time; and the following items are stated from recollection, the account being read in that journal at the time of pub-

lication with much interest. The same system had been followed up for a considerable time by the same cultivator, and it was stated that he never failed to raise one hundred bushels of shelled corn to the acre. The year of this extraordinary crop of 196 bushels to the acre, was a very favorable one for corn. The sod of eight years in grass was plowed deeply in the fall, the winter freezing and thawing making it very mellow; in the spring it was re-plowed with a smaller plow, harrowed out three feet each way, and planted between the 20th and 25th of March, from four to six inches deep; the latter depth much preferred; six to eight kernels in the hill. When it was fairly out of the ground, the large triangular harrow was dragged over the rows (the front tooth being taken out.) by two horses, one walking on each side. When the corn was about a foot high, the small plow was run twice in the rows with the bar next and very close to the corn, throwing the earth from it, and the stalks in each hill reduced to four. It was also plowed in the same way crosswise. Shortly after, for fast working was the rule, the plow was run through the rows twice each way with the mould board towards the plant, throwing the earth to it. The corn grew so rapidly that little more working was required, and when four feet high, it completely shaded the ground; the weeds stood no chance, and excessive evaporation was prevented. From its early start, it had the benefit of the best rains, and reached an early maturity, sufficient for cutting up at the ground in the usual way. It is evident, on comparing this method with others commonly followed in similar latitudes, that it is only practicable as to time of planting and depth of covering, where the situation is unusually warm, and the soil favorable for very rapid growth. The rich grass ley plowed in the fall and re-plowed in spring, so as to disturb the decaying sod as little as possible, and the rapid culture after planting, have been recommended by others.

(*b.*)—In the Ohio Agricultural Report for 1862 it was stated that there were annual applications to the State Board of Agriculture for premiums on corn crops. These set forth under oath all the details of culture, expense and product; and these statements were annually forwarded to the State Board of Agriculture, and published in the annual Report. Since 1850, sworn statements of the following crops had been received viz: Nine crops over 150 bushels to the acre, eight between 140 and 150 bushels; nine between 130 and 140; thirty-four between 120 and 130; twenty-three between 110 and 120; sixteen between 100 and 110; nineteen between 90 and 100; twenty-one between 80 and 90; in all 139 crops producing between 80 and 160 bushels to the acre.

(*c.*)—Two crops of corn in Fairfield Co., Ohio, competing for the premium for the largest yield on one acre, offered by the Agricultural Society of that County in 1862, were described as follows: S. Barr took the first premium—99¾ bushels; bottom land; first crop after grass, plowed in the spring; marked out both ways; corn harrowed and plowed three times.—W. Graham, a competitor, raised 92 bushels to the acre on soil, black mould meadow; sod broken in March, under-drained; planted about May 5th in rows three and one-half feet each way; from three to five stalks in the hill; well attended with cultivator and shovel plow.

(*d.*)—In 1869 S. R. Humes of Champaign Co., Ohio, took a premium for 85 bushels on one acre, awarded by the Agricultural Board of that County, and described the soil producing it of that kind known as "barrens," composed largely of yellowish sand and clay, one to two feet deep; then a stratum of lime, gravel, clay and sand mixed, two to four inches thick, and very hard, which dug up and pulverized, looks like a mixture of sand and lime. Underlying this a bed of limestone gravel of indefinite thickness. The cornfield was the oldest on his farm, and had been in cultivation

over sixty years; was near the barn; during the previous winter cattle and horses were fed on it, till it was thickly covered with corn-stalks; was plowed in March with a three horse plow, eight to ten inches deep, turning all the stalks nicely under, was well harrowed and rolled, and marked out forty-four inches each way, with a double shovel marker; planted May 14th and 15th; and worked four times with a double shovel plow.

Robert Belt took a premium from the Union Co., Ohio, Agricultural Society in 1869 for 81 bushels 36lbs., on one acre; soil second bottom, sod plowed for the first time; no manure used; planted with a drill, three and one-half feet wide, on May 25th; plowed through twice with a double shovel; husked November 4th and 5th.

(*e.*)—At the nineteenth annual exhibition of the Carroll Co., Ohio, Agricultural Society, premiums were awarded to W. S. Easterday for 160 bushels of shelled corn on one acre, and 132 shelled per acre, on three acres of corn, and to Jas. McCausland for 114 bushels shelled on one acre; modes of culture not given.

(*f.*)—One of the most remarkable crops on record was raised by a farmer in the northern part of Hamilton Co., Ohio,—172 bushels of shelled corn to an acre, on white oak upland, part of a farm considered run down; it being a clover and timothy sod of three years standing. In the fall and winter of 1846 some thirty head of hogs were fattened on corn scattered over the worst part of the field. About March 1847, it received a moderate dressing of barn-yard manure; was plowed from six to eight inches deep; corn planted in rows four feet apart and averaging about one foot distance in the rows. Its first appearance was unfavorable amongst the large pieces of hard clay; but by degrees the yellow patches disappeared, and as soon as the roots pierced the clay to the sod, the plants had a healthy color and rapid growth. During

the whole cultivation, care was taken to disturb the sod as little as possible. Two loads of turnips on the same acre came off with the corn. This crop shows the value of hog manure in bringing up corn land.

(*g.*)—In the same year a crop of 122 bushels two quarts on one acre in Harrison Co., Ohio, took the premium; soil black limestone, plowed late in the spring, cultivated three times, and hoed twice; it being the third crop in succession taken off the land. It must have been a first rate soil to have worn so well. In the same year a Lorain County farmer took the premium for 160 bushels per acre raised on land always pastured till 1846. Plowed eight to sixteen inches deep and planted in corn. In May 1847, plowed two inches deeper, and ridged about three feet apart, the rows the other way three and one-half feet apart. Used the cultivator first, twice in a row, once one way, and once the other, and hoed. Second time, twice in a row one way, and once the other, not hoed. Used the Michigan or Harmon's improved cultivator. Cut and shocked October 8th. Lorain is one of the Lake counties whose moist and equable climate has been spoken of herein.

(*h.*)—To show what can be done on Ohio bottoms after forty-seven years cultivation without manure, one of the premium crops grown by Ohio County Societies is noticed in the U. S. Agricultural Report, 1868, as follows: H. N. Gillet, of Lawrence Co., raised on one acre 99 bushels 12¾ lbs corn, soil one-fifth white oak, sandy clay loam, balance alluvial with blue clay subsoil; land broken about a foot deep, harrowed once, and laid off three feet nine inches each way; planted with Gillett's improved corn; worked each way, when quite young, with cultivator; hoed once, and thinned to two stalks, plowed twice, and just before the tassel appeared, worked by running the cultivator across the furrows of the last plowing, holding up the side of the plow next to the row, so as to barely scarify the surface near the corn.

Some of the prize corn crops of north-western Ohio from 1849 to 1870, as tabulated in the Ohio Geological Report for 1870, were, in Crawford Co., 1849, three acres, 87 bushels to the acre; in 1851, 88⅓ bushels; in 1852, 126; in 1853, 129¼; in 1859, 128; in 1860, one of 160 bushels on one acre, one of 152½, one of 131 and one of 138. Allen Co., in 1852, 110½ bushels to the acre, in 1853, 94; and in Auglaize Co., in 1870, 123¼ bushels on one acre. Henry Co., in 1853, produced 137½; Mercer, in 1852, 97¾; and Putnam in 1859, 109 bushels. This part of Ohio was more recently settled, much of it being swampy.

(*i.*)—Large crops are not so common in the southern States. One in 1845 was mentioned as taking the prize in Buncombe Co., North Carolina, of 113½ bushels to the acre. Several cases of large ears are recorded. Two ears were left at the office of the Savannah Republican (nearly fifty years ago) for inspection, which grew on the same stalk; one had 1140 grains, the other 1020; said to be average ears of a fourteen acre field of corn, three miles from Savannah, Georgia.—An ear of corn measuring sixteen inches in length and seven in circumference, grown in the State of Tabasco, Mexico, was presented to the Editor of the New Orleans Picayune. Ohio has grown some large ears. The Western Herald, (Steubenville.) mentions one thirteen inches long and ten in circumference, with forty rows, each sixty grains, total 1200, left at the Herald Office. New Jersey grew a cornstalk more than six inches in circumference, and thirteen feet nine inches high. The only manure used was eighty bushels of stone lime to the acre.

(*j.*)—Pennsylvania is not generally so remarkable for extraordinary crops as for very good averages. A very good description of the method of raising 100 bushels to the acre is given by a farmer of Venango Co , in the U. S. Agricultural Report for 1853. A meadow, clover field or old pasture is

chosen; if wet or spouty, is thoroughly drained; twenty-five to thirty loads to the acre of good manure, or more of inferior, are added; one load spread at a time, and immediately plowed under; a handful of plaster being dusted on each heap as deposited in the field. Old lands are mostly plowed nine inches deep and subsoiled; new lands plowed more shallow; the furrows are so well turned that no grass will harrow up. After a few days drying, the field is harrowed till there is enough loose soil to cover the corn; but not enough to make the ground very smooth, lest the rains should make it heavy. The furrowing is shallow enough not to disturb the sod; wider apart for the large varieties, three feet for eight rowed yellow. For planting, settled weather and warm soil in good condition to receive the seed are waited for, say for latitude 41⅓°, from the middle to the last of May. A variety adapted to a colder climate should be at hand, when an unfavorable spring makes the usual time unsuitable, or for second planting when the first fails. The ground being well prepared shortly before planting, the most careful hands drop the seed, four or five grains in a hill to be distributed over a space six or eight inches in diameter; followed by others with hoes to cover every grain away from the birds. If these begin taking up the corn, a bushel sown broadcast over the field will protect the whole crop. Plaster may be applied at planting. As soon as the plants are fairly up, the rows are dressed thoroughly with the corn harrow or cultivator, followed by hoes, killing every weed and every particle of grass; those in the hills being removed by hand. A little plaster is dusted on each hill at this stage, or a larger quantity sown broadcast; if ashes were not applied at planting, they are applied now. The crop to be kept clean with the shovel plow or cultivator, finishing with the common plow passing three times in a row; the third time very deep, and a thorough hoeing without hilling. This working is finished about July

4th, the field being entirely clear of weeds. Thus tilled the land yields at least one hundred bushels of sound shelled corn per acre, costing but a trifle more than a crop of fifty bushels.

A crop in south-eastern Pennsylvania was reported about the year 1845, of 101¼ bushels to the acre on old grass sod of twenty years standing. Seven years before it received a dressing of lime, fifty bushels to the acre. It was broken up in the spring seven inches deep, with a Prouty plow, marked out four and one-half by four feet, six grains planted in the hill between the 1st and 5th of the 5th month, May, which were thinned to four. Corn up two or three inches high, each hill was plastered—the only manure used. The after cultivation was with the corn harrow, and once with the shovel plow, the weeds not reached by the harrow being subdued by the hand hoe. Much was due to deep plowing with the Prouty plow, which was very effective in pulverizing the sod as it was turned over. This was in about latitude 40°, showing an earlier planting than the last named crop by nearly two weeks.

Another Pennsylvania crop was reported in 1845 of 1820 bushels raised on twelve acres, or 151 bushels to the acre, on a field originally the poorest on the farm. It was more or less a re-planting after the first had been cut off by the cutworm and blackbirds. A compost was made of twenty-five bushels of leached ashes, ten of plaster of Paris, sixteen of lime, and about fifty of fine sheep manure, well mixed on the barn floor, and the lime dissolved with beef and pork brine. A handful of this compost was put in each hill of corn till it was found insufficient for the whole twelve acres, and then divided between two or three hills for the balance.

(*k.*)—Chemung Co., New York, in 1845 had five premium crops, the samples of corn exhibited being all good, and the product per acre being respectively 123, 121¼, 113¾, 119½ and 107½ bushels.

An experiment reported (1845) from Waterloo, New York, shows what can be made out of a peaty swamp—140 bushels of sound corn per acre. After the second hoeing, in the height of the summer drought, when the ears had commenced forming, the whole of the loose peaty mass was found full of moisture, probably due to its fine state of decomposition.

The year 1847 seems to have been prolific in premium crops. Different County Societies in New York reported premiums on the following yields per acre, 143, 140, 137, 129, 127, 124, 116, 112, 110, 107, 100, and so on down to fifty bushels.

(*l.*)—Connecticut about the year 1844-5 furnished reports of several large crops; one to the Middlesex Co. Society of one-fourth acre producing at the rate of 151 bushels to the acre on sward ground highly manured and planted three feet apart each way. Another in Middletown, on sward rolled after plowing. and two coats of fine hog-pen manure placed on top and harrowed in, about sixty-five cart loads to the acre; planted May 20th, four kernels in hills three and one-half by two and one-half feet apart. Soil gravelly loam; the seed was rolled in plaster; the suckers were all removed from the hills at the last hoeing; produced 108⅛ bushels to the acre of corn with ears well filled with large kernels; the quality very superior.

Bridgeport furnished the following account of highly successful croppings: Old meadow land turned over in early November with a heavy subsoil plow, followed by a heavy roller over the furrows; cross plowed in the spring and harrowed twice. Is manured with a mixture of one-third creek mud, or decomposed vegetable matter, one-third stable or barn-yard manure, one-third unslacked lime taken from the bottom of the kiln. Five grains of the best selected corn are planted in hills three to four feet apart, and as the corn shows itself, unleached ashes are placed on the outside of the young

plants, the rain or atmospheric moisture carrying it to the roots of the plants. The field is kept clean from weeds, and hoed three times. In the summer of 1842–3, nine acres of corn were planted, one-half L. I. yellow, and one-half Long Island white, two acres of the resulting crop were measured, one white and one yellow—the white gave 236 bushels of well grown *ears*, the yellow, 224. The atmosphere in that neighborhood being too salt for the use of plaster, its application to land was given up.

(*m.*)—Massachusetts has an early record in respect to large yields per acre. John Andrew, of Salem, in 1827 raised 166 bushels of corn from one and a half acres, more than 110 bushels per acre. A Berkshire Co., correspondent (1845) says that more than twenty pieces of land in corn were reported as producing one hundred bushels to the acre and over. From the U. S. Agricultural Report, 1869, it appears that the annual increase on the crops of this State was slight for the previous twenty years. It only needed the timely application of wood ashes to the hill, and careful stirring of the soil to produce seventy-five bushels per acre.. In Dukes County, an island off a bleak coast, three farmers raised respectively 109¼, 108½ and 102¼ bushels of maize.

Vermont, (Windham Co.,) in 1845, reported a premium crop of 106 bushels to the acre, from the use of muck. An old number of the American Farmer gives a sketch of the possibilities of corn raising as follows: It might be possible to make some fraction of an acre of ground so perfect in its soil as to produce and maintain to maturity, one stalk of Indian corn upon every twenty-four inches of square surface. If we allow one good ear to each stalk, and half a pint of grain to each ear, the product would be about at the rate of 168 bushels to the acre. It would be a very easy matter to try the above experiment by making the hills of corn two feet apart each way, planting three or four kernels in a hill, and

leaving at the first or second time of hoeing, but one stalk in a hill; each kernel to be planted at such a distance from its next neighbor, as to be pulled out "without deranging the economy of the hill."

Higher yields than this have already been mentioned from seed planted at distances apart common at the east and frequent at the west.

(*n.*)—As an offset to the large crop from peaty soil in the north, above referred to, we give a recent one from swamp land in Georgia on 1.012 acre (210 feet square) which took the premium at the State Fair at Macon. It was "branch land" (creek bottom) black mud, or a muck swamp five feet deep, mixed with sand, and before reduced to cultivation was covered with brush and cane. The plot was bounded on three sides by a small running stream or "spring branch," formed by cutting into the ditches five feet deep, and making a ditch of the same depth on the fourth side. By the time the drainage was completed and the swamp cleared of its growth, the season was far advanced. The land was then broken up with Bloodworth's iron plow with subsoil attachment, and the soil bedded up, leaving water furrows forty-five inches apart; three hundred bushels of fresh horse manure were then distributed in the furrows, by the side of which the plow was again run, covering the manure. Red cob gourd seed, previously soaked in water till in sprouting condition was drilled in the last made furrow, ten inches apart, on June 1st, 1869. Midway between these drillings and in the same furrows, Dickson's guano was dropped, a spoonful at a time; direct contact of the corn either with the guano or the horse manure being thus avoided. The land being warm, the corn appeared in a few days. A turn plow was then run each side of the row, throwing the earth away from the corn, which was then hoed and thinned. Ten days after a shovel plow was run around the corn, followed in a week after by a

turn plow throwing the earth to the corn. This process of throwing to, was repeated after ten days. Another ten days elapsing, the earth was drawn up around the corn by a hand hoe, ten inches high. About August 1st the drought set in, and for the purpose of irrigation a dam was thrown across the outlet of the ditches and the water backed upon the soil. The crop obtained was $137\frac{1}{7}$ bushels of corn, or 135½ bushels per acre. Net profit $136,07 per acre.

(*o.*)—What an acre of prairie soil can be made to yield of maize is shown in one of the reports of competitors for the premium offered by the Coles County, Illinois, Agricultural Society. 106⅔ bushels per acre were produced, or 1,066⅔ bushels on ten acres of old prairie ground, twelve years in meadow, plowed early in April, seven inches deep, harrowed well, and planted in May, three and one-half feet each way, and covered with hoes; plowed five times with cultivator or shovel plow, and hoed twice, thinning to three stalks in the hill. Another entry was made of ten acres prairie loam, barley stubble, plowed ten to twelve inches deep with a three horse team, and planted two and one-half by three and one-half feet, cultivated three times and shovel plowed once. Yield 1063½ bushels, or an average of 106⅓ bushels per acre.

(*p.*)—The hilly county of Washington Ohio, produced in 1847 a premium crop of 144 bushels of corn to the acre, and another on high hilly land of 117 bushels. In the same year the Trumbull Co., Agricultural Society reported a crop of corn on two acres measured and producing 200 bushels on upland, sandy and gravelly soil, which had been in spring wheat the year previous, plowed in the fall and again in the spring and manured with barn-yard manure, planted about May 25th in hills four feet apart one way and three and one-half feet the other, attended with the cultivator, and hoed twice. The same farmer exhibited to the measurers another

field planted in rows three and one-half feet apart each way, lacking a little of two acres, of which they adjudged the product to be 110 bushels to the acre.

(*q*)—An experiment was tried near Columbus Ohio, an account of which was published in 1858, on bottom land which for forty years previous had never been plowed to a depth exceeding six inches, and which had been cultivated carefully in corn during the entire period; plowed 11¾ acres eight inches deep, subsoiled eight inches deeper, and planted corn May 10th. Adjoining this a tract was plowed to the usual depth of previous years, and planted with corn May 7th. On the shallow sod the corn came up and looked for a few weeks as well as on the deep plowed land, but when the heat of July came round, the corn on the shallow plowed land came to a stand still; the leaves curled and drooped, and gave unmistakable evidence of suffering from drought; while that on the deep plowed land was growing vigorously, and found no lack of moisture; the result being 120 bushels to the acre on the latter, while the shallow plowed tract produced less than forty bushels.

(*r*)—The heaviest yield on one acre on this list is mentioned in the U. S. Agricultural Report, 1870, as being reported by J. W. Parker to the annual Convention of the South Carolina Agricultural and Mechanical Society, for 1869.

The mode of culture which produced this yield, together with the one preceding it on the same ground, is thus described. A quagmire was selected, grown over with rushes, willows and sour grass, abounding with snakes and malaria, and traversed by a winding sluggish stream. "Thorough drainage was attained by the construction of a canal and underdrains, and during the summer the land was cleared, leveled and broken up with a two horse plow." In November a heavy coat of cow-house manure was plowed under, and the process repeated in January, and again in March

with subsoiling. In April a heavy growth of weeds was limed and turned under. In May another coat of manure was plowed under, and the land harrowed perfectly level, and laid off in rows three feet apart. In the furrows were applied Peruvian guano, salt and plaster at the rate of 200 lbs. of each per acre. The seed corn, soaked in a solution of niter and rolled in plaster, was dropped ten inches apart in the rows, and covered with rakes; after which the land was rolled. The corn was up in five days from planting, and as soon as it was sufficiently large, a long narrow plow was run round it, followed by the hoe. The corn was kept clean by shallow, level culture till it began to shoot and tassel; the field was then irrigated by conveying from a reservoir, gently flowing water through every alternate row. The yield on two acres was 147 bushels per acre. The following year the experiment was repeated in like manner, except that the rows were laid off two and one-half feet apart. One acre yielded 200⅜ bushels, as attested by a viewing committee.

Mr. Parker attributed much to irrigation in the above results. His conclusion from these and previous experiments was, that successful maize growing depends greatly on deep fall and winter plowing; underdraining of moist land, followed by judicious manuring; deep early and shallow late working; the roots not being disturbed after the corn begins to tassel.

(*s.*)—Sufficient examples have been adduced to show the importance of selecting for a corn field a sod of several years standing, and in most cases of plowing it deeply; and if the subsoil is stiff clay, or otherwise impervious to moisture, except in the case of rock bottom, of treating it with the subsoil plow; of applying, in the case of land long cultivated, a liberal coat of barn-yard manure, either on the sod before plowing, say in the fall or winter; or on the plowed land in spring, and harrowing it in well; of furrowing out so as not

to disturb the sod, from three to four feet apart in hills according to the height of the stalks and the fertility of the soil, in the middle and northern States, and wider apart for the largest varieties at the south, or in drills distant apart according to a similar rule, with an average of one foot apart in the drills; of planting in average seasons from the 1st to the 25th of May in the northern, middle and western States, and earlier going south; of leaving but four stalks in the hill at most, and generally but two or three; of beginning the process of cultivation as soon as the corn is fairly out of the ground, with harrow, cultivator, or double shovel plow, assisted with hoes if necessary to effect a perfect weeding at the start; of applying ashes or plaster in small quantities to old lands in the neighborhood of the young plants; of plowing deeply close to the rows only when the corn is quite young and the roots are not widely extended, being careful in all cases to disturb the sod as little as possible, consistent with thorough pulverization of the soil; of leaving but short intervals between the several stirrings until the stalk is about four feet high; and of watching the earing time, to remove all ears affected with smut as fast as they appear.

(*t.*)—In looking over the above list of large crops to the acre it will be seen that they have been raised mostly on lands which have been for a considerable time under cultivation; some on bottoms, some on uplands; some on clayey, some on sandy and gravelly tracts; some on peat soils, and some on reclaimed swamps.

The heaviest crops were raised either on a sod of long standing, in the most favorable location for growth, and deeply plowed; or they received an abundant manuring.

As little has been said in these statements on the proper depth of planting the seed, we extract from the U. S. Agricultural Report, 1868, the result of experiments by a Pennsylvania farmer who planted corn with a pointed stick at

depths of one, one and a half, two inches &c., up to six inches. The grains planted at one inch came up in eight and three-quarter days. Those at one and one-half inches came up in nine and one-quarter days. Those at depths from two to five inches came up in periods ranging from ten to eighteen days, proportional to the depth of the seed. Of those at five and one-half inches, only ten grains came up. Those at six inches did not make their appearance at all. Of those at five inches only forty-two grains attained a height of six to eight inches. Those planted at the depth of four and one-half inches, produced no ears of full size. Those at one and one-half inches produced the best corn. Those at one and two inches gave sound ears, but inferior to those just mentioned. He concludes that the proper depth for planting corn is from one and one-half to two inches. This may stand as a general rule, but it cannot make an "absolute guide, in view of the conditions of diverse soils."

CHAPTER XIII.

FERTILIZERS—SECTION I.

Substances which promote the growth of the maize plant, applied by human skill or industry, are called either fertilizers or manures. The former from its derivation seems the most comprehensive term. Some of nature's fertilizers are more essential. Solar light is necessary to the action of the leaves in the decomposition of carbonic acid; carbon being retained for the upbuilding of the plant, and oxygen returned to its great reservoir. Solar heat is one of the most important aids of growth from germination to ripening. The atmosphere is a great fertilizer, supplying not only carbonic acid but oxygen, which the plant takes up at night, while it gives

out carbonic acid, and also such combinations of nitrogen as ammonia and nitric acid, formed, it may be by electricity, or taken up by evaporation.

(*a*.) The atmosphere is a great laboratory for vapor, visiting the plants with dew or rain; it also acts as the receiver and transporter of sundry volatile matters held in suspension, including particles of solid bodies, besides immense numbers of minute living creatures on the wing. That electricity is also a fertilizing agency may be inferred from some experiments detailed in U. S. P. O., 1844, although the profitableness of its employment as such is questionable. Enough has already been stated herein to show that water in motion is one of the greatest fertilizers, and in some cases its natural action has been a grand substitute for all the fertilizers of art. Water answers nearly all the purposes of a manure, it forms from $\frac{1}{11}$ to $\frac{1}{7}$ of the maize grain, and an increasingly large proportion of the stalk, going back to its first appearance above ground. It is a carrier to the maize plant of its food, from higher levels and especially from the clouds. It also distributes the plant food through the soil, making it accessible to the roots; but this is dependent on the finely divided condition of the soil, as produced by cultivation. But in percolating through the soil it tends to open it up; it holds the food of the plant in solution, and thus fits it for easy and rapid absorption of fertilizing elements. On the other hand it may be supposed that water leaches away from a soil its more soluble substances. But this may be to a great extent prevented by deep and thorough cultivation. A sponge opening freely holds a great deal of water, which is forced out by compression. So if the soil is kept open and spongy, it retains all the water it needs. This soaks through a deeply stirred soil, which takes from it, as it passes, the needed fertilizing matters it has in solution, but from a shallow plowed soil having much of a slope, it runs off, making channels of its own, and

carries with it portions of the soil in suspension. Masses of water, to aid plant growth, must be in motion; stagnant water chills the plant and hinders growth.

(*b*) The word *manure* from the Latin *manus*, a hand, seems the better term for substances applied in aid of plant growth by the hand of man. Other fertilizers, including water, may operate directly on the plant without the intervention of the soil. Manures properly speaking are applied *to the soil.*

Some thirty years ago experiments were made by which a substitute for the manuring of the soil was supposed to be found in the soaking of the seed with special manures. Testimonies to remarkable results from the process were quite abundant in certain quarters. Stalks of Indian Corn were made to produce four or five ears, and some eight or nine ears. It was claimed that enveloping the seed with the manure was a better security against leaching and waste, than the application of it to the soil. The stimulus given to the growth of the seed by imbuing it with manurial substance, has been generally acknowledged and frequently taken advantage of, especially by those whose crops are endangered by early and late frosts, as in the more northerly latitudes; by those whose planting has been delayed by a wet spring, making timely plowing inadmissible; and by others to insure an early and rapid growth as a protection against worm destroyers. It is probable that the rapid development of the stem and roots enables them sooner and more effectually to extract fertilizing gases from the atmosphere, and to take up manurial substances from the soil; that is if the tillage is deep and thorough.

But after the first year or two, there is risk of a light grain crop from heavy stalks, unless the soil is too fertile to need manuring. To make the crop reasonably certain in soil cropped for a long time, the spreading of fresh manure, or putting that well rotted in the hill, is usually necessary to satisfy the

appetite of the plant stimulated by soaking the seeds. The ability of the soil to take up and retain all the plant needs of its proper food contained in the manure or otherwise absorbed, is dependent on the soil being in good condition.

(*c.*) The uses of manure are to feed the plant, or assist its digestion, or to present the food to the roots in a soluble form, or put the soil in the mechanical condition required for absorbing and retaining fertilizing substances, or for correcting its injurious acidities or other faults. Some manures answer nearly all these purposes.

(*d*) Manures have been classed as organic and inorganic. Organic manures may be of vegetable or animal origin. The inorganic substances having existed before the organic, may be first considered. In the order of material creation, lifeless forms are older than living ones. As to all manures, it is highly important, in order that the soil may get the full benefit of them, that as fast as wanted they should be finely divided, or in a soluble state. To make combinations or mixtures complete, atom should meet atom; it is the office of some manures, however, to promote this. But as the manurial properties are not all in demand by the plant at once, and some varieties of maize and other plants are longer growing than others, the most soluble manures should be applied to those of quickest growth, and *vice versa.*

(*e.*) *Inorganic manures* are mostly the results of the disintegration of the rocks on the earth's surface, more or less combined with the elements of the atmosphere, or its floating gases and water. Most of them have been alluded to on page 12 herein, and in the respective inorganic analyses; the six leading acids, (combinations of oxygen, with the simple bases, carbon, phosphorus, nitrogen, sulphur, silica and chlorine), being the carbonic, phosphoric, nitric, sulphuric, silicic and chloric acids which form salts with the metallic earths, lime, magnesia, potash, soda, silica, alumina and iron. Then there

are oxides of iron and manganese; iron, having the protoxide (with the lowest proportion of oxygen), considered hurtful to plant growth, and the peroxide with a higher proportion useful to plants. Ammonia, (nitrogen and hydrogen) sometimes called a salt, forms salts with carbonic and sulphuric acid; the latter having the strongest affinity for it, displaces the former from the carbonate of ammonia, (which usually descends with the rain, and is easily volatilized), and forms the permanent but soluble salt, sulphate of ammonia.

(*f*) *Lime*, and compounds, form a very large proportion of the inorganic manures in use, and are called calcareous manures. In the maize grain its quantity is smaller than in the stalk, but it is most useful for other purposes than plant food; as quicklime it is extensively applied to clay lands to make them more porous, and to sandy soils, to make them more coherent; to soils over-stocked with crude vegetable matter to decompose it rapidly; to sour lands, to neutralize the acids, and to soils rich in organic matters to produce nitric acid, which forms with various bases the rich manures called nitrates. In England from 150 to 300 bushels are applied to an acre at a time, but less at shorter intervals on light than on heavy soils, which with abundant barn yard manure, receive the largest amount. It soon becomes slack in that moist climate, forming the *hydrate*, and erelong, by taking up carbonic acid, becomes a carbonate or mild lime, which is slower in its operations, but beneficial to soils, and much more suitable for plant food.

In the United States where the sun is hotter, not more than half the above amount is usually applied. The limestone from which it is burned at a high heat, is very abundant in parts of the Allegany region, and it has been widely used in the middle States, and considerably in New England. Eighty bushels to the acre are spoken of as a fair allowance for sandy land, 100 bushels for loam and 150 for clay. This sup-

poses the presence in the soil of sufficient organic matter; 200 bushels are sometimes applied when this is very abundant; where it is scant, or the soil is light, a much less quantity is allowed. In Dauphin Co. Pa., in 1851, it was said that 100 bushels to the acre, repeated every eight years was the proper quantity for limestone slate, gravel and clay loam; on red shale and sand, 50 bushels every 4 years. A Mifflin Co. Pa. correspondent of U. S. P. O. speaks of it as more beneficial than any other agent in making the texture of the soil crumbling and permeable to water. On good limestone soil its favorable effects were not so apparent, but it changed the spontaneous weeds from blue grass and sorrel, to the Lamb's quarter, mallows and Spanish needles peculiar to rich gardens. Applied with a view to its double operation on soil, 100 to 200 bushels should be allowed; in combination with manure, double the highest quantities might be advantageous. Others recommend applying to poor lands often and in small quantities.

To ascertain if a soil needs lime, it has been recommended to put a small quantity of soil in a tumbler, and pour on it first a little water, then a good deal of spirits of salts or muriatic acid; if it effervesces strongly, lime is not needed, if not, liming or marling may be useful.

After several applications of quicklime, the sour insoluble humus being exhausted, it was found better to apply it in a milder form; say by throwing it into heaps of 20 or 30 bushels, and leaving it two months in summer, and four or five in winter, till it became a mild carbonate. It was then ready as food for the plant, and as a medium through which it could obtain carbonic acid, which the lime reabsorbed as fast as it was furnished to the plant. In Pennsylvania, lime is frequently spread on corn ground in a slaked state after it is plowed, and before furrowing out for planting. It is also frequently put on ground with stable manure, when preparing

for wheat; some place it on the sod. Lime enables mixed earths to convert nitrogen of putrefying and decaying animal and vegetable substances, into nitric acid, with which it forms a nitrate. It is said that plants develop faster in soil manured with it, so that they complete the period from germination to maturity sooner than on unlimed ground.

Carbonate of lime is less active, but answers an important purpose when finely divided, whether by crushing, or by burning and slaking, and then leaving the lime a long time exposed to the weather. The chief materials containing lime are limestone, marble, chalk, marl, stalactites, stalagmites, shells and calcareous spar. Several writers speak of the porosity given to clay lands, by the addition of lime, as occasioned by the lime when it has again taken up carbonic acid, which was burned out of it. Carbonate of lime is insoluble in pure water. Its elements are, carbonic acid, 43.7, Lime, 56.3.

(*g.*) The *bi-carbonate*, containing two proportions of carbonic acid, is soluble in water. When water contains carbonic acid gas, it has the power of dissolving the carbonate of lime sufficiently to form the bi-carbonate. This salt parts easily with its second proportion of acid, when long exposed to air, or heated over a fire. Stalactites in caves, petrifactions in lakes and streams, some beds of marl, drains choked with lime, and crusts at the bottom of kettles and steam-boilers are thus accounted for.

Limestone may be mixed with silica, alumina, magnesia, oxide of iron, a trace of the phosphates, potash and soda, and often with animal or vegetable remains. The best limestone has but 5 pr ct. of these; some specimens burned have not lime enough to slake with water. Quicklime is the residuum when high heat applied in kilns drives off the carbonic acid. A bushel of lime weighs from 75 to 100 lbs. and should be bought by weight. As to construction of kilns

and the process of burning and slaking, see U. S P. O., 1856, p. 204 to 210. The slaked lime made by pouring on water is the hydrate of lime, a chemical compound; 3 lbs. of pure lime taking up a pound of water. Uniform slaking, with which too much or too little water interferes, makes the finest powder. Rich limes watered, kept from the air, slake fast with heat enough to kindle gunpowder strewn on them, and gain in bulk 2 to 3½ times. Too much water supplied, or too fast, may chill the lime to a gritty powder, full of obstinate lumps. It is best for land in the finest powder, which is obtained by leaving it on the field in winter, covered with sods till completely fallen, or ready for application to crops.

Limestone is extensively diffused throughout the United States; the older calcareous formations of the Atlantic States cover a wide belt nearly coinciding with the Allegany chain.

All the New England States have more or less; New York is very rich in limestone, New Jersey in green sand, Pennsylvania and Virginia in limestones and marls. Limestones more or less pure abound in Ohio, Michigan, Kentucky, Missouri, Iowa, Illinois, and other Western and South-Western States. The connection of the limestone formations of the Mississippi Valley, with such successive geological formations as the Lower Silurian and others are fully set forth in the U. S. Agricultural report of 1869.

(See Danas' Mineralogy and Geology.)

Chalk, a carbonate of lime, is abundant in England and other countries; and is so soft that it has been extensively applied to land without burning. It makes gravelly soil tenacious and close, and clay soils porous, and sands firm. For this 400 to 1,000 bushels are applied. Chalks containing more clay are required in smaller quantities. For coarse, sour, earthy pasture, 150 to 250 bushels to an acre produce a sweet and delicate herbage, and it rids land of sorrel. Lime, as stimulus, is best in large doses at wide intervals—once

in 5, 6, 7 years according to nature of land. As manure it is best in small quantities applied frequently and composted with earth, clay and other matters. Most varieties of subsoil strata make good compounds with lime. Except to new land, it is much the safest applying lime mixed with earth, sand, clay, turf or vegetable mould. As quick-lime sets free the ammonia from guano and fermenting manures, it should be applied a little before or after the application of these, or on the surface, so as to prevent their admixture. Lime that has become mild from exposure to air on or under the surface hurts no manure. Burned oyster shells aired a few hours, to slake, are the best lime for the land. 300 bushels of lime to an acre will cover the surface $\frac{103}{1000}$ of an inch deep; 100 bushels $\frac{34}{1000}$; 90 bushels $\frac{31}{1000}$; 80 bushels .027; 70 bushels .024; 60 bushels .021; 50 bushels .017; 40 bushels .014; 30 bushels .010; 20 bushels .007. Crude limestone crushed, is applied with effects slower, but more lasting than quick-lime; but is not an active solvent, or absorber, nor so finely powdered as the hydrate, or chalk. The fine powder made by slaking burned lime, is more equally diffused in the soil, combines quicker with the acids, and touches more nearly the roots of grass, straw, leaves, &c; promoting their decomposition.

Beds of impure limestone for the manufacture of cements and hydraulic mortar, when burned and ground to powder, cannot be applied so as to improve land like the purer limestones as they harden to stone by combining with the water or moisture of the soil. Limestone countries often in hollows and hillsides, exhibit banks, and heaps of sand and gravel, containing rounded particles of limestone, called limestone sand and gravel; being carried down by water from decaying limestones and other rocks. These greatly improve boggy land.

(*h*) *Chloride of Calcium:* common salt and slaked lime being mixed, the salt is decomposed, the soda becomes caustic,

and the lime a chloride of calcium, containing 63 $\frac{38}{100}$ pr ct. of chlorine gas, very deliquescent, bitter in taste, and dissolving in one fourth its weight of water at 60° F. Chalk or quicklime dissolved in muriatic acid produces the same. It is found in the sea water, the refuse of salt pans, and the waste of bleacheries; improves vegetable growth. It may be more convenient to use common salt, 100 to 300 lbs. to acre, with slaked lime say three times those quantities. The salt may be dissolved in water, and thrown on the lime. It is a great help to maize, if spread on land mixed with leached ashes, charcoal, saw-dust or gypsum.

(*i.*) *Chloride, or Oxymuriate of Lime*, when dry, is pale and greyish white; a good article has 25 to 30 per ct. by weight of chlorine gas. It is a hydrate of lime mechanically mixed with chlorine. Its partial solution in water evolves chlorine; the freed lime becoming an insoluble carbonate in the bottom of the vessel. Kept in a dark place, or exposed, when dry, to heat, it loses its chlorine. It is not known as a necessity of plants; but some suppose it to operate like gypsum in fixing ammonia, and aiding the germination of seeds. Much of it has been thrown away in the refuse of bleacheries.

(*j.*) Gas lime is the refuse of gas works. Some analyses by Prof. Johnston show in 100 parts, from 56 to 69 carbonate of lime; from 2¾ to 29⅓ gypsum; from 2¼ to 14 $\frac{9}{10}$ sulphite and hyposulphite of lime; (the latter being soluble in water) from 9½ to 12 $\frac{9}{10}$ water and coal tar; and small quantities of caustic hydrate of lime, prussian blue, alumina, oxide of iron, sulphur, insoluble matter, and sulphuret of calcium. There is some risk in applying it to growing crops, unless the components are well understood; but having very little caustic lime, it may safely be mixed at once with barn-yard manure, but not in too large quantities. Mixed with guano, it would tend to fix the ammonia; exposed to open air it gradually absorbs carbonic acid from the atmosphere; most slowly in damp situations.

(*k.*) *Nitrate of Lime*, (lime 34.46, nitric acid 65.54), is a result of chalk or limestone dissolved in nitric acid; is often produced naturally in compost heaps to which lime has been added; is found in rocks and in the soil; effloresces on the plaster of old walls, and is abundant in the mammoth cave of Kentucky. It is very soluble in water and deliquescent, decomposed by fixed alkalies; with potash forming saltpetre, and with soda cubic nitre; is contained in hard water, which, according to Dr. Home, is much more promotive of plant growth, than soft water.

(*l.*) *Oxalate of Lime*, (oxalic acid and calcareous matter) is a white powder, very insoluble in water, but soluble in muriatic and nitric acids, is hardly plant food; may be decomposed by sulphuric acid, forming gypsum and oxalates of magnesia, and other salts, which are soluble and highly favorable to vegetation, when not superacidulated.

(*m.*) *Phosphates of Lime* are the results of variable proportions of phosphoric acid combined with lime, of which, the most abundant and the most useful in agriculture, are the earthy parts of bones, and the native phosphorite. They are less abundant in corals, oyster shells, and shells of other fish; in the teeth, horns, nails, hair and other parts of animals, and in the horny wings and covering of numerous insect tribes. The phosphate of lime is a minute part of nearly all limestones and marls, and most fertile soils; it is found in the stalk and grain of maize.

The bi-phosphate of lime is formed from burnt bones, powdered and dissolved in sulphuric acid, diluted with once or twice its weight of water; the remainder of the lime forming gypsum with sulphuric acid. It has 28½ in 100 parts of lime, and 71½ phosphoric acid. Liquid manures from the urine of animals contain it. One of the best liquid manures for grain crops is the above superphosphate, mixed with gypsum and largely diluted with water. Pearl-ash added to

the solution till it begins to turn milky, will produce a mixture of the phosphates with the sulphates of lime and potash; if soda added, the phosphates with the sulphates of lime and soda, both being improvements on the bi-phosphate. Simply adding potash and soda to the solution of bones in sulphuric acid, and drying it up with charcoal powder, a vegetable mould, will make a good top dressing for hand sowing or drilling in.

Bone earth: the ash of bones contains 51½ parts of lime, to 48½ phosphoric acid.

Apatite, or phosphorite, in masses and veins abounds throughout the world, and when pure has 54½ parts of lime, and 45½ phosphoric acid. Dr. Daubeny from a bed in Spain six or seven feet thick, of unknown depth, one entire white, radiating, silky mass, obtained samples nearly as fertilizing for grass and turnips, as bone manure; and inferred that the rich manure of bone was chiefly due to the phosphate, and not to the oil or gelatin. Phosphorite has been mined in the United States, at Crown Point, near Lake Champlain, and in Morris and Sussex counties, New Jersey. It may be ground and spread on old grass lands, or dissolved in diluted sulphuric acid, for grain crops, 1,000 to 1,200 lbs. per acre. It mixes with the rocks where it occurs; and must be analyzed to find how much acid will dissolve it. Carbonic acid water 1 gal. dissolves 30 grains of bone earth, driving off part of the phosphoric acid, and combining with what lime separates from it, and the phosphoric acid combines with the other portion of the phosphate of lime, making a superphosphate soluble in water, and a carbonate of lime found among its sediment. The phosphorite of Morris Co., New Jersey, is first ground, then heated with sulphuric acid, to produce the superphosphate, then mixed with wood ashes and thrown into the compost heap, or otherwise distributed on the land. In some cases the pulverized mineral has by itself been mixed with the compost.

Wherever vegetable matter decays in the soil, the water carries to the roots of the maize plant, carbonic acid, with common carbonate of lime, and some of the needful phosphorite dissolved in it.

(*n.*) *Silicates of lime:* the glassy salt or mixture of two or more silicates from silicious sand, mixed with quicklime—abounds in granite, trap and other rocks—is found in the ash and probably in the leaves and stems of plants. The moisture and carbonic acid of the atmosphere, slowly decompose these silicates, freeing the silica and forming carbonate of lime. Rain and dew, full of carbonic acid, dissolve the carbonate of lime, and some of the silica, and diffuse or carry them to lower levels. Soils on decayed trap, or on masses of a wholly rotten rock, owe much of their acknowledged richness to this long drawn out liming process. Around iron furnaces, the first slag obtained, which accumulates greatly, is largely silicate, which may be laid on boggy or peaty land in large quantities, giving by their slow decomposition to growing crops, a long lease of lime and silica, and to soil, solidity and firmness.

(*o.*) *Gypsum:* sulphate of lime, (water 21, lime 33, sulphuric acid 46; calcined, lime 41½, sulphuric acid 58½), is white and crystalline; deprived of water at low red heat, forms Plaster of Paris, which, made into paste, with water, unites chemically with it, and in a few minutes forms a hard substance used for casts, &c. A ton of pure gypsum crushed yields about twenty-five bushels. It is found in nature as selenite and alabaster, and almost free from water, as anhydrite; is seen in peat, and is an element of lucerne, sanfoin, ray grass, red clover and turnips, and in the excrement of most, if not all grazing animals. It is often found in springs. Plaster was used in agriculture by the ancient Romans, Britons and Lombards; but not much in modern times till after its discovery as a manure by a German clergyman in 1768.

Its use gradually spread in Germany, France, Great Britain, Switzerland and the United States. Dr. Franklin sowed in large letters, in a clover field in Washington City, in powdered gypsum, the words, "this has been plastered." Near Philadelphia and elsewhere it has been successfully used ever since 1772. E. A. Kendall's travels (1807) mention it as very highly prized, as restoring vigor to exhausted soils, and making up for inferior husbandry in the farming district between Litchfield County, Connecticut, and the Hudson River. It was imported from Nova Scotia, and sold for ten dollars per ton on Hudson River, but has since been found near Niagara Falls, near Cayuga Lake, at Martha's vineyard, and other places in New York, Maryland, Virginia, Ohio, &c.

Gypsum is thought to extract ammonia from the atmosphere, and retain it for the use of plants, and to fix in the soil, this and other soluble essentials to plant growth. This fixing of ammonia is also thought to take place when gypsum (plaster) is scattered over stable floors, dung heaps, and manure tanks; sulphate of ammonia, and carbonate of lime being formed by its sulphuric acid uniting with the ammonia, and the lime with the carbonic acid of the volatile carbonate of ammonia. This last comes down also with rain water from the clouds, and when it fails to meet gypsum in the soil, is quickly volatilized. The sulphuric acid of the gypsum decomposes and stimulates the humus and insoluble matter in loams or peaty soils, and this humus is needed in the soil to make gypsum an effective fertilizer. Too much humic acid will combine with the lime of the gypsum, forming humate of lime, and the freed sulphuric acid may corrode the maize roots. There may be an excess of gypsum in a soil very rich in humus; but in proper quantities it makes the delicate and juicy leaves better absorbents from the atmosphere. Powdered raw, it does not swell in water. Heated first below redness, and wet with its bulk of water, it hardens

in five or ten minutes; another dose of water, and when beginning to harden, a third dose given, and so on five or six times, and the mixture grows weaker; then divided into clods and left to air, it is easily powdered fine. The plaster has now more surface to water, and is more soluble for the roots of plants. The particles acquire five or six times their original bulk from repeated additions of water. Over-roasting prevents this thorough expansion. It is $1/5$ stronger for expelling the water. When aired it takes up chemically as much water as it lost by burning, without being weakened as a manure. Its solubility enables it to enter plants entire. Strewn over young growing crops, it stimulates the leaves most when the dew is still on them. For clover, it is best strewn over the field before winter and harrowed in with the seed; being thus more evenly exposed to the action of the roots. It is in wet, warm seasons, that the water carries it to the maize roots, and the leaves will only de-oxidize the sulphuric acid when aided by the sun's rays. Gypsum will not always succeed unless applied discreetly and alternately with other manures. In America its use helps Indian Corn, buckwheat and rye, and most on light, dry and sandy soils. It is said to want considerable moisture to make it active. It has proved beneficial to chalky and limestone soils, especially soon after marling. It fails when vegetable matter is exhausted, and should not be too often repeated on the same soil, especially if very rich. Most soils require a change in manures as well as crops once in five or six years. Maize at planting, or at first or second hoeings, is best plastered in the evening or morning on dew, or in calm and cloudy weather just before or after a slight rain; very rainy weather lessening or destroying its effect. It has been applied in fall and winter, so that the rains of the season might dissolve it. Some writers say, apply five or six bushels per acre to corn, but the correspondents of the U. S. P. O. from 1849 to 1853 give various

amounts, from one to two bushels, and from five to one hundred lbs. per acre as the usual application. They speak of beds of plaster in Onondaga and Ontario Counties, New York, and of others at Sandusky Bay, and Grand Rapids; Onondaga and Sandusky plasters were considered nearly pure sulphate of lime. The price in Hillsdale County Michigan, in 1851, was $10 to $12 per ton; at Adrian, $6 per ton. Plaster was used more or less in the New England States, New York, Delaware, Pennsylvania, Maryland, Virginia, North Carolina, Mississippi, Michigan and Ohio, and generally with great advantage. Some correspondents from New Hampshire and Vermont were exceptional in stating that in some cases it was of little benefit. Several spoke of it as beneficial on all soils, others that it was mainly useful on slaty hillsides, and dry sandy soils, and those resting on felspar and hornblende, and on soils suited to clover and winter grain. It was so suited to red clover, that like man and wife, they were not to be divorced. Some thought that previous liming neutralized the plaster, and that the lime found sulphuric acid in the soil and formed gypsum.

On corn land it was often used with ashes in the hills at planting, the corn being dropped on the mixture; but much oftener a handful at the first hoeing, soon after the corn was up, or half a spoonful, some say a table-spoonful of plaster alone, or if put in the hill with barn-yard manure, a gill. It has been mixed with guano, 133 lbs. per acre, to plaster $\frac{1}{30}$ of a ton. Plaster entered into various composts with lime, ashes, muck and barn-yard manure, which were successfully applied to corn land. Seed corn was frequently rolled in plaster, with or without previous tarring to hasten its growth. The sprinkling of plaster once a month during winter on the manure heaps, increased the crops greatly and gave greater action to the manure through the subsequent season.

As the geology of the United States becomes better known,

new beds of gypsum and other fertilizers will be laid open. In U. S. Agricultural report for 1868 is an account of the chief beds in West Virginia, including 40 miles along the valleys of North Holston and Walker's Creek, between Walker's and Clinch Mountain. The gypsum is in boulders embedded in clay; only a beginning has been made in working and transporting it. From analyses it appeared fully equal to the Nova Scotia plaster.

(*p.*) *Marl* contains not less than one-fifth its weight of carbonate of lime; with less than this it becomes a marly clay or soil; *lime* mud, more and less pure, is the result of deposits in low levels by the latest great floods of the globe. Weather beaten rocks containing much lime, when exposed to air, and especially to frost, have furnished in a few cases, carbonate of lime, which, in the marl thus formed, is sometimes 70 or 80 per cent. Quicklime, by long exposure becomes a very rich marl; so finally does lime applied to the soil. Marls are white, gray, yellow and blue, and differ in coherence and composition.

Clay marls have the appearance of stiff clay, but are powdered by immersion in water, or long exposure to air. Like lime, they prepare the food for the rootlets; give the plant a wide field to feed in; and make the soil an absorbent from the atmosphere; having usually 60 to 80 per cent. of clay, and 20 to 32 of calcareous matter, silicious sand, &c.

Stony marls, often more calcareous than clay marls, have less power of neutralizing acids and producing salts, and require a larger quantity for the same effect. These and clay marls make light sandy soils more solid. Sandy marls make stiff soils more easy to work.

Shell marl helps all soils greatly, it drinks water and swells like a sponge; is said to attract acids more strongly than clay and stony marls, and to require six times the quantity to saturate it. It is not exhaustive of the vegetable matter of soils, and

may be applied to soils exhausted by lime and the other marls, or may be repeated. It dissolves sooner than the other marls and operates quicker—is slower than lime, but more lasting. Limed land, exhausted by cropping, is not restored by other than shell marl, and marled land so conditioned is not restored by liming, but may be by a muck composted with dung. Marl should be applied to light, barren land, 1,000 or 2,000 bushels per acre; to soils in good condition one-fifth or one-sixth of this, once in six or seven years.

(*q.*) *Corals* are marine polypifers of various colors, with stony or horny axes; are mostly carbonate of lime; may be shrub like or rounded.

Coral Sand is of the same nature, and in France has been much used in the same way and with the same effects as marl. Its saline and animal matters are weakened by long exposure to air, and so it is preferred fresh. The Normans compost it with farm-yard manure to great advantage. Coral and other shells abound in Florida; the reefs and shoals of the Keys of Florida and Bahama Islands are often entire masses of broken coral shells and infusoria, and could manure all the cultivated land in the United States for thousands of years. (T. G. Clemson, U. S. P. O., 1856.)

(*r.*) *Coprolites* are cone-like fossils of ancient calcareous formations, and are said to be petrified excrements of extinct animals. They are found in Maine, and many limestone formations in other States, with other fossils; mostly in layers of rocks; sometimes as pebbles, coarse gravel, or more comminuted particles. A sample analyzed by Herepath had of phosphate of lime, magnesia and iron, 53.7; carbonate of lime 28.4; gypsum 0.7; silica 13.2; water 3.4; being about as rich in phosphate and carbonate of lime, as recent perfectly dried ox-bones deprived of their fat. Though intensely hard, they are readily dissolved by sulphuric acid, into an excellent manure.

(*s.*) *Magnesia*, (protoxide of magnesium), an important element of maize, and of the muscles, tissues and fluids of most animals, abounding in nature with lime as a carbonate, and in soapstone and serpentine as silicates, is a very light, white, odorless, tasteless powder, and very insoluble in water. *Carbonate of Magnesia* rarely occurs pure in nature, but is precipitated from the sulphate, (Epsom salts) or calcined from the impure natural or artificial carbonate. Its properties resemble those of calcined magnesia, having 51.7 carbonic acid, and 48.3 in 100 of magnesia. One of its chief sources is magnesian limestone or dolomite, found in various European localities and in Canada, in parts of Maine, Vermont, Massachusetts, Rhode Island, New Jersey and Virginia; abounding on the banks of the Hudson, in Niagara and Onondaga Counties, New York. Among its out-crops in the United States were noticed in 1868, specimens from Sullivan County, New Hampshire, containing 46 6 per cent. of carbonate of magnesia; from Addison County, Vermont, with 44¾; from Worcester, Hampshire and Middlesex Counties, Massachusetts with 27 to 43.35; from North-East Rhode Island 32.5 to 40.6; from Niagara, Dutchess and Westchester Counties New York 20.70 to 45.89; from five Counties in New Jersey 17.4 to 20.3; from Newcastle County, Delaware 46.6; and from three Counties in Maryland, with magnesia 17 to 18 per cent.

Limestones abound in Pennsylvania and Virginia, some of which are magnesian; in Madison and Buncombe Counties, North Carolina, are found magnesian limestone. In 1869, analyses were published giving Lawrence and Marion Counties, Arkansas, limestones with 35.05 to 42.3 per cent. carbonate of magnesia; Pike, Benton and Franklin Counties, Missouri, others, with 20.02 to 42.05; the Silurian limestone, chiefly magnesian, occupying nearly two-thirds of the width of Missouri, East and West, reaching the Missis-

sippi River in Cape Girardeau County, and extending Northward. Thick beds of dolomites were found in East Tennessee; analyses of Kentucky limestones in fourteen Counties gave carbonate of magnesia a percentage from 15.59 to 45, the highest in Jefferson County; of Illinois magnesian limestones in nine Counties, 16.08 to 60 per cent; in seven Counties of Iowa, from 15.72 to 43.93 per cent.; in five Counties of Wisconsin, from 27 49 to 41.70; in nine localities of Minnesota, from 13.75 to 42.43 per cent; in six localities of Michigan, from 12.21 to 44.39. Magnesian limestones are said to abound in the Trenton formation in Pennsylvania, and the Trenton lead bearing limestone of Wisconsin and other adjoining Western States; among the Niagara limestones extending from New York beyond the Mississippi; and among the carboniferous rocks on the sides and tops of several of the Great Western mountain chains, and about the head waters of the Missouri, and in the Colorado basin.

Opinions somewhat contradictory are held as to the injurious effects on plants, of the lime containing it, when the magnesia is in large quantity. Three samples from New York State gave on analyses respectively, $27\frac{1}{5}$, $12\frac{9}{10}$, and 4 in one hundred parts of magnesia; the last (Onondaga), said to be as pure as chalk and most agricultural limestones. Common limestone containing carbonate of magnesia, highly heated in the open air, loses its carbonic acid; the carbonate of magnesia more readily, and at lower temperatures than the carbonate of lime. That is, it sooner becomes caustic; it slakes when water is poured on it, and falls to powder; the hydrate of magnesia swelling with less heat than lime. Burned and slaked lime containing magnesia, has two hydrates: the magnesian hardening under water, and in a wet soil, in about eight days, forming a hydraulic cement.

Though the hydrate of lime will not do this, a mixture of the hydrates of lime and magnesia will form a solid mass;

and the particles in wet soil, or during rains, falling first after application, will become gritty. The supposed injurious effects from caustic magnesia are ascribed to its remaining longer caustic, and not uniting with carbonic acid so readily; to its forming a harder mortar with water, and so being apt to cake about the stems and roots of plants. Mild magnesia, where calcareous matter is deficient in the soil, helps vegetation, being found in the ash of the maize plant. Some deny that the magnesian carbonate is injurious to land at all. It is said on the other hand of the various acid substances in the soil, both of organic and inorganic origin, which lime applied to land makes innoxious by combination with them, that they unite rather with the caustic magnesia, and form salts, more soluble in water than compounds of lime with the same acids; so that the water carries through the rootlets into the circulation, too much magnesia for the health of the plant.

Limestone rich in magnesia, but not containing it in excess, yields the most powerful and lasting fertilizing effects. The ashes of various grains give a percentage of magnesia, 11.1, against lime, 3.4. In maize and millet, magnesia is to lime, as eight is to one. Magnesia is essential to the seed and herbaceous structure. Caustic magnesia applied to richly manured land, so as to be not over one-fifth the animal or vegetable remains, soon becomes mild, but on land where a portion of quicklime already occupies the surface, the magnesia remains caustic, and the quicklime grows mild.

Caustic magnesia destroys woody fibre as quicklime does, and with strong peat helps to make manure. If the peat is equal to one-fourth the weight of the soil, and the magnesia does not exceed one-twentieth, the proportion may be considered safe.

Chloride of Magnesium is the white mass resulting from evaporating to dryness a solution of calcined or carbonated magnesia in muriatic acid (chlorine 73 65 magnesium 26.35),

—is often found in ash of plants. It forms three and a half per cent. of the Atlantic water, and twenty-four per cent. of the Dead Sea; abounds in the mother liquor of salt pans. It might be applied to the young plant from a water cart, dissolved in a large proportion of water.

Nitrate of magnesia, (nitric acid 72.38, magnesia 27.62,) attracts moisture from the air very rapidly, and only wants cheapness to be highly beneficial.

Phosphate of Magnesia, (phosphoric acid and magnesia), is probably in most soils in minute quantities, and helps the action of urine and most manures.

Silicates of Magnesia are components in part of hornblende and augite, and in chief of serpentine and talc, and so abound in soils they form, but are apt to decompose and the magnesia to leach away from high ground.

Sulphate of Magnesia (Epsom salts), a very volatile salt, was proved by Sprengel to act on growing plants like gypsum, but is too costly to supersede it.

(*t.*) (U. S. P. O., 1860.) *Hydrate of oxide* of potassium is an impure compound of all the soluble salts leached from wood ashes and dried. Pearl-ash has fewer impurities. Pure or caustic potash is solid, white and fusible, and not decomposable by heat, but is deliquescent, and when exposed to air, absorbs its carbonic acid, and will effervesce with sulphuric, nitric or muriatic acids. It is one of the strongest of the the bases, and so caustic as to alter all organic substances it touches; it dissolves many animal substances, and changes the nature of vegetable products, especially when aided by heat. In nature it is always combined with acids, as the carbonic, sulphuric, chlorohydric, nitric, oxalic, tartaric, &c. That from vegetable ash is mixed with divers other salts, varying according to the vegetables from which the ashes have been procured, the nature of soil and manure used in production. The tartrate of potash reduced to ashes, makes

the purest caustic potash. Potash is a component of animals, plants, and soils that support vegetation, and of such rocks as granite, mica, the schists, sienites, lavas and basalts. To soils formed from rocks, not containing it, (quartz and many chalks), it must be supplied.

Silicate of Potash is one of the constituents of feldspar and mica, which are constituents of granite. *Greensand* is found along our Atlantic coast, and largely in Delaware and New Jersey, where it is extensively used as a fertilizer, and contains seven to thirteen per cent. of potash. Commercial potash comes from the ashes of plants. Ashes have been long known as a powerful fertilizer, and much of their power is due to the potash contained.

Nitrate of Potash (saltpetre), has 53.45 nitric acid, and 46.55 potash; is soluble in water, especially at high temperatures. Of tried value as a fertilizer, it wants cheapness. It is used for soaking grain as a protection against insects. It only occurs native as an efflorescence on limestones, marls, chalks and rocks, containing lime and potash. For the formation of saltpetre, besides the presence of lime, magnesia and potash, a certain degree of humidity is essential. The temperature must be favorable; the formation of nitrates being very feeble at or about the freezing point; the sunlight is unfavorable. Gay Lussac in 1825, published instructions as to artificial nitre beds in Paris, to the effect, that all the nitrogen necessary for the formation of nitric acid was yielded to it by animal matter, and nitrate of potash is never generated from the air, in substances adapted to its formation, without the co-operation of animal matter. There were twenty-two nitre beds in Ceylon—caverns increased by successive extractions of material. Bowles states that there is enough nitrate of potash in Spain to supply all Europe to the end of time. The action of the salts of potash will be shown by the remarks on those of soda.

(*u.*) *Sodium* and its salts, are like potassium and its salts, abounding in nature, and in being always combined with some acidifying principle. Sodium is soft and ductile, silver gray, waxy, and lighter than water. Soda, (oxide of sodium) is the result of quicklime depriving the carbonate of soda of its acid. It absorbs greedily the humidity of the atmosphere and deliquesces, but exposed to air, absorbs carbonic acid and effloresces.

The *Chloride of Sodium*, (table salt), gives the ocean its bitter flavor. Rock salt is found in all sedimentary rocks throughout the world, from the transition to the tertiary; it is supposed to be a deposit from sea water. The atmosphere contains all the salts of sea water. Common salt in moderate quantities is not only food for the plant, but makes the phosphates and other substances available for nutrition. But where rain comes from the ocean saturated with salt, as in certain parts of Great Britain, no marked results may follow its application. For cereals, two to three hundred weight may be applied to an acre in moist weather, one-half of that quantity at first, and the other half a fortnight after.

Silicate of Soda is found in some varieties of feldspar. *Carbonate of Soda*, (soda 58.57, carbonic acid 41 43), crystallizes from a concentrated solution by cooling, and when exposed to air, effervesces. The strongest heat does not decompose it, unless in contact with water. In the desert of Thiat, in Egypt, a lake fills up during rains with the carbonate and sulphate of soda; the carbonate is separated. Sea weeds contain soda with vegetable acids. In Spain and France soda is obtained from various weeds and cultivated plants, and also from the chloride of sodium, (common salt), by evaporation; it being first treated with sulphuric acid, and the resulting sulphate of soda then heated in contact with carbonic acid and charcoal; the residuum being lixiviated, evaporated and crystallized.

Sulphate of Soda named from Glauber, its discoverer, is colorless, bitter and nauseous; an old purgative, is fusible below red heat and crystallizes in long six-sided prisms; exposed to air, it parts with its old water of crystallization, effloresces, and at last falls into a white powder. It is found in sea water; in the Artesian wells at Louisville, Ky., (2,086 feet deep), the waters of which abound in various fertilizers; 330,000 gallons being thrown up in twenty-four hours, and ejected to a height of one hundred and seventy feet above the earth's surface. With such wells it seems hardly possible that the manurial resources of a country can be exhausted. Sulphate of soda is also obtained from certain mineral waters evaporated and crystallized; and from the mother liquor from which common salt has been extracted. It has 43.82 parts of soda and 56.18 sulphuric acid.

Nitrate of Soda, (nitric acid 63.5, soda 36.5), is contained in the cubic peter of Chili, composed of nitrate and chloride of soda, sulphate of potash and nitrate of magnesia, formed in beds or layers on a dry plain, 3,300 feet above the sea in North Chili. The beds are several feet deep and extend forty leagues; occurring with sulphate of lime, sulphate and chlorohydrate of soda, and recent oceanic shells. It is imperfectly refined, dissolved, evaporated and crystallized; packed in bags and sent mule back to the coast. The wood used in preparing it is also packed on mules from a distance.

(*v.*) *Silicium*, pure, owes its mode of preparation, and the history and properties of many of its compounds to Berzelius (1823). It is a part of most known minerals, and is, after oxygen, the most abundantly diffused of simple substances. Rock crystal is a pure oxide of it; it is found mixed with oxide of iron, &c, and combined with various bases. When pure, it is a dark brown powder, infusible before the blowpipe; its oxide, silica, silicic acid, quartz crystal, is tasteless, inodorous, and without action on vegetable colors. All

the salts of silicic acid are insoluble in water, except those of potash, soda and lithia. It is a component of the crystalline rocks round the molten centre of the globe, either amorphous, crystalline, or forming salts with various bases. It occurs in all the metamorphic rocks; very abundantly in red sandstone; is found in glass and slags from furnaces, and enters widely into sedimentary deposits. Glass and mortars are silicates. It is a component of plants in various proportions; more of grasses than other substances. The epidermis of some reeds contains silica, crystallized enough to blunt the edge of a knife in cutting the stalk. The quantity of silica in any one plant varies in its different parts, in different varieties, and on different soils. Root crops bring up soluble silica from the deeper parts of the soil, or assist in reducing crystallized silica to a soluble condition in the upper parts for the use of corn crops. The greater part of the soluble silica taken from the soil by a whole course of crops may be returned in the leaves or tops of root crops Silica gives mechanical firmness, strength and resistiveness to parts of plants most apt to break or fall down; it abounds most in the chaff coats of ripened grain; next in the culms; after them in the leaves; least in the pulp or farina of seeds and flesh of succulent roots. Available silica is so abundant in most soils as to make special applications unnecessary.

The chief soils now requiring direct application of it are peat lands, and such as are so overstocked with humus that corn culms grown on them are too soft to stand the weather. Yet many scientific farmers and some distinguished agricultural chemists contend that artificial silicates should be applied to all soils. See Wilson's Rural Cyclopedia, volume IV., page 218.

(*w.*) *Aluminum* resembles tin and silver, but is bluish when hammered; when pure, is unalterable by air or water. Its oxide *alumina* is one of the component parts of alum; is

the chief constituent of clays, and mixed with other substances coloring it, is inodorous, nearly tasteless and somewhat astringent. It attracts water strongly, and when heated, readily gives it off. The more alumina a clay soil has, the more tenacity. Sun or wind dried, it hardens, cracks, and becomes obdurate; it is the hardest soil to subdue, but is very retentive of manures, and opened to the air, is a great absorbent of ammonia. The ashes of plants seldom contain alumina, and then sparingly; but it is a help to the soil and a purveyor of food to plants. It is seldom or never uncombined; is generally a silicate, sulphate or phosphate. Aluminous minerals are very extensively diffused. Prof. Voelker thinks aluminous earths have the power of absorbing and retaining fertilizing principles so combined, as readily to yield them to plants, without being leached away by rains or running water. Alkalies and other fertilizers abound in feldspar, albite, mica, basalt, clinkstone, claystone and other aluminous minerals. Clays may be made comparatively porous, dry, warm and fertile, by paring and burning, the particles being thus partly fused, and made to cohere, and form a gritty mass, containing the elements inherent to clay with the properties of sand. The application of sand to cure the tenacity of clay soil is expensive. Burnt clays have an increased power of absorbing ammonia, but a great part of their retentiveness of moisture is lost. Roots and fibres of weeds and all noxious seeds are thus eradicated. The alteration of the inert vegetable fibre existing in soils, when subjected to this operation, increases productiveness by converting useless and injurious matter into assimilable plant food. Or a product may be thus obtained, having an advantageous chemical action upon the inorganic constituents of the soil. The charcoal resulting from burnt inert vegetable matter, has a surprising power of absorbing and condensing fertilizing gases. Paring and burning would make poor sandy

soils worse, but improve rough old pastures having a basis of clay, infested with moss or noxious insects, or having a thick coarse turf that will burn by itself, or with the addition of brush, coal, &c.

(*x*.) *Oxides of iron and manganese* are abundant in nearly all soils, perhaps because plants make very little use of them. The protoxide of iron tends strongly towards the peroxide, and hence its superior absorption of the oxygen falling in rain. Drainage or subsoiling would probably do away with the unhealthy effect of the protoxide. Soils containing iron compounds, are not bettered by organic or putrid animal manures, which take the oxygen from the peroxide. The peroxide absorbs and retains ammonia for the use of plants, yielding them nitrogen as they want it. Experiments by Prince Horstman on oats, to test the necessity of inorganic constituents, proved them necessary to the development of the plant, and ripening of the seed. Iron being absent and all other bases present, the plant was very pale, weak and disproportioned; without manganese, was not perfectly developed and bore few flowers. His researches show that chlorine is essential to the growth of wheat. That the mineral food, both for vegetables and animals, be ready prepared, is essential to animal life. Rocks furnish the soil, and soil the inorganic constituents; if one essential is missing, growth fails.

(*y*.) The *ash* resulting from the combustion of an organic substance in contact with the air, is exclusively the mineral portion, varying with the nature of the plant, the port on consumed, the geological formation and other characteristics of the place of its growth. The leaves, branches, trunk and roots all differ in ash. Assimilation is most active in the leaves, which use more mineral food than any other part. In all organic vegetable matters, the mineral portions of the ash are differently conditioned from those of the plant. In the

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latter they are more or less combined witn combustible organic acids, which are destroyed in the burning of the plant, leaving the minerals more or less altered, or differently combined. Silex, in the plant, minutely divided and soluble, becomes insoluble by the effect of heat; and the alkalies may form insoluble compounds with silica, indefinitely inert. Excessive heat in combustion may diminish or destroy the fertilizing properties of an ash. Charcoal, resulting from imperfect combustion, is a condenser of gas, absorbing when powdered ninety times its volume of ammonia. Ashes are impoverished by lixiviation. The ash of plants yielding much phosphoric acid, potash or soda, is more valuable than that of plants containing less of them. Soils without organic matter are little helped by ashes.

Peat ashes divide stiff soils. Peat ashes are said to differ materially from those of wood, and to have three times their manurial value, but this probably depends on the circumstances of the peat formation. If the bogs lie in calcareous formations, their ashes have a special value in the salts of lime, for top dressing of swards and clover. See analyses in U. S. P. O. 1860, pages 71–72. A writer in the New England Farmer thinks them better for winter than summer grains. Charred peats from Holland give English soils a warmer hue; lightens clays and helps them in their absorption of ammonia. Sprengel says a good dressing will last five or six years. The bottom layer of a peat bed yields the best ashes. Coal ashes in some respects have the properties of peat ashes. Coals are metalliferous, containing much sulphuret of iron, or copper; others abound in various earths. Combustion in contact with air, dissipates the sulphur and leaves the oxide of iron. Prof. Norton's analysis of anthracite coal, (white ash), gives matter insoluble in acids, 88.68, soluble silica, .09, alumina 3.36, iron 4.03, lime 2.11, magnesia .19, soda .22, potash .16, phosphoric acid .20, sulphuric acid .86, chlorine .09.

Berthier found in bituminous coal of St. Etienne (France), alumina insoluble in acids, sixty-two parts; do soluble five; lime six, magnesia eight, oxide of manganese three, oxide and sulphuret of iron sixteen. Coal ashes have long been used with night soil, and are of great use around slaughter-houses, as absorbents of the blood and liquids, manures of the quickest action. They take the stiffness out of clay, and introduce the absorbed nitrogen. More than one-fourth of the one hundred and fifteen correspondents of U. S. P. O. from 1849 to 1853, who speak of fertilizers, refer to the use of ashes, either at planting or before the corn is up, or when it gets up, or at first hoeing, with or without gypsum, or generally as top dressing; unleached is preferred. One refers to the prevalent use of coal ashes, two mention potash; a few speak of applying ashes to general composts, others protest against its use with ammoniacal or barn-yard manures. Of the mineral composts applied, three are mentioned as one-half plaster and one half ashes, one as two parts of ashes to one of lime, one of one-third plaster to two-thirds leached ashes, another three parts leached ashes to two of slaked lime and one of plaster. At planting, a gill to the hill of mixed plaster and ashes was sometimes applied. These were mostly in the Middle and Eastern States, where the value of ashes for manuring maize crops was very generally appreciated.

At a discussion on mineral manures, referred to in the Report for 1870 of the Massachusetts State Board of Agriculture, Col. Wilder said there was nothing so much wanted as potash on old soils of New England that have been long cultivated; he considered ashes at fifty cents per bushel for manure the cheapest for any crop. Mr. Thompson of Nantucket said that on land so poor that it would not spindle corn, he had applied coal ashes two or three inches deep, mixed with a little loam; then plowed and harrowed, and in three years the land was so much renovated that he cut a ton and a half to acre of best clover.

(*z*) Sulphur is mostly obtained from volcanic regions, from sulphurets of iron, copper, &c., or combined with oxygen as sulphuric acid, forming with bases sulphates of barytes, lime, strontian, &c. Putrefying organic matter owes part of its odor to sulphuretted hydrogen. It is seen on the surface of stagnant pools, and is deposited by certain mineral waters. It is a non-metallic combustible; its specific gravity 1.99, melts at 216°, crystallizing as it cools. Is insoluble in water, but in special cases makes water milk-white. The acid is one of the strongest known. The proportion of sulphur in plants has been shown to be greatest in straw and leaves.

(*&*.) *Phosphorus* has been shown to be found where its presence was formerly not even suspected. Many of our accepted analyses ignore it. "All the requirements of vegetation exist in the air and soil; the want of phosphoric acid and ammonia is more imaginary than real; the former is found in all rocks, oceans, water, air and soils, and in ample supply for animated nature; its not having been detected by chemical experiment in the air, is not conclusive proof of its non-existence; there are higher evidences than the results obtained by chemical reagents and balances; the omnipresence of phosphoric acid and the known presence of ammonia in the air, water and soil, are natural consequences of the order of creation. Chemistry has settled the question that phosphorus is a constituent of organic substances; it exists uncombined in the brain of animals; it will not be extraordinary, considering the solubility of phosphoric acid, if it exists dissolved in atmospheric humidity." Some remarks on the dosage of phosphoric acid are given in U. S. P. O. 1860, page 78.

Considering the extent of its uses in the animal and vegetable creation, phosphoric acid is probably the most important substance in agriculture. Phosphorus is an essential to the life

of animals and vegetables. It was first discovered by an alchemist of Hamburg, by evaporating urine and calcining the residuum. Afterwards it was obtained from the bones of animals.

The simple phosphorus is yellow, tough and wax-like, and may be solid, liquid or gaseous. Its luminous character, when exposed to air, is due to its burning slowly with oxygen. When inflamed in the air, or in oxygen gas, it emits white fumes, and collected free from humidity, is white and pulverulent, and absorbs the humidity of the atmosphere (deliquesces) and liquefies. It combines with oxygen in several proportions; one forming phosphoric acid contains five atoms of oxygen, and one of phosphorus, and forms phosphates with lime, magnesia, manganese, iron, &c. That of lime is called *apatite*, and is found granular, fibrous, compact, friable, or crystallized in stalactites. It is colorless, or yellow, blue, violet or green; transparent, translucent, or opaque; is found in granite, gneiss, chlorite and talcose slates, in trap and basalt; in metalliferous deposits with copper, lead, &c.; in coal slates and chalk; in tertiary formations, and in sedimentary and tufaceous deposits now forming. It is associated with fluoric acid in mineral, vegetable and animal matters, such as the teeth of animals. Though very widely diffused, phosphoric acid is less abundant than silica, lime, magnesia, and alumina, except in special deposits. Phosphate of lime is a fixed salt, neither soluble nor volatile, and when removed from the soil must be replaced by manures. The amount returned from the barn-yard is very much less than that carried away in grain, hay, milk, bone and flesh, on the most economically conducted farms.

This results from continued cropping, loss of phosphoric acid, faulty culture, and leaching streams. Lands naturally irrigated or formed from rich phosphatic rocks, may hold their own unaided. England now grows largely by emigration, and imports of bones, and other fertilizers from Holland,

Germany and South America. In 1842 bones were exported largely from Hamburg, Rotterdam, Bremen, Lubeck, Kiel, Rostoch, Stettin, Elsinore and Dantzic. In 1837 bones imported into Great Britain were valued at £254,600, the home supply fully £500,000. Mineral matters, a small item in young animals, increase with age. The bones of children have more water than those of adults. Muriatic acid dissolves out the mineral part, leaving the gelatin or cartilage with the original form of the bone. Glue is thus made. The dissolved part consists of phosphates of lime and magnesia, fluoride of calcium, carbonate of lime, and a little salt of potash and soda.

The following analyses of bones are from Berzelius:

	Man.	Ox.	Pike.	Whale.
Gelatin, (soluble matter)	32.17 }	33.30	*37.36	*78.46
Gelatin, (vessels)	1.13 }			
Phosphate of lime	51 04	55.45	55.26	14.20
Carbonate of lime	11.30	3.85	6.15	2.61
Sulphate of lime	....	....	....	0.83
Fluoride of calcium	2.00	2 90	and loss	0.74
Phosphate of magnesia	1.16	2.05	....	....
Soda and muriate of soda	1.20	2.45	1.23	2.46
Sulphate of soda	....	....	....	0.70

*Organic matter.

One hundred parts of Gelatin of bones fermented make twenty-two pounds of ammonia, together with carbonic acid. Phosphate of lime is soluble in acids, and all phosphates in an excess of acid. The phosphate of lime in bones hid in a manure or compost heap, is dissolved in the humidity by the carbonic acid evolved, and more or less rapidly according to the activity of the fermenting mass. It is slower in the large bone, than in its powder; in coarse powder than in fine. Bones are crushed on a large scale in steam mills. Steaming or boiling takes out the gelatin for glue, and the grease for soap, after which they are easily powdered, but have less

fertilizing power. Burning the bones destroys the organic matters, except a part of the carbon, (animal black).

Charred bones are a great deodorizer, and antiseptic, and condenser of gases. Charring them, in iron cylinders or other air-tight vessels, saves much of the carbon driven off by burning in the open air. If the bones are treated with sulphuric acid, without being powdered, insoluble sulphate of lime is formed, which surrounds the part of the bone not already acted on and prevents the further action of the acid. The use of muriatic acid carries the decomposition to completion, but the phosphates and muriates will be in solution, and less conveniently applied. For other reasons also the sulphuric acid is preferred, if not diluted. This added to crushed bones, forms a sulphate with part of the lime, and the effervescing carbonic acid escapes, and it also frees phosphoric acid from part of its lime, which combines with the phosphate not decomposed and forms a super-phosphate. Sulphates of potash, soda and magnesia are also formed. The result of a well conducted operation is a dry powder; the gelatin of the bone becoming more easily assimilated. Any farmer can make his own super-phosphate and save the risk of buying a humbug. The proper density of the sulphuric acid is about 1 85. The finer the powder the more acid is required, and the more complete the action. Bones burnt in contact with the air are said to yield an average of fifty per cent. bone ash, for every one hundred pounds of which eighty-seven or eighty-eight pounds sulphuric acid will be required. These well mixed in a hogshead with five or six gallons of water, with a paddle, will foam up to 212° Fahrenheit, or higher. The acid may be added in two portions successively. In handling the acid, care must be taken for eyes and clothes, which have sometimes been the forfeit.

The mass mixed till it stiffens should be covered and left for a day, then thrown out in a dry place till ready for pow-

dering, or mixed with dry peat, charcoal, calcined plaster of Paris, dry mould, or saw-dust, and powdered. The work may be done on a tight floor, on the ground, or in the field, where the powder is used, as well as in a hogshead. A Westchester, Pennsylvania farmer got bone dust (1870) in the cheapest possible way by putting the bones in fresh horse manure. Others have recommended putting a layer of bones broken to a convenient size, on a layer of peat, muck or mellow soil in a molasses hogshead, covered with four or five inches depth of ashes—when the layer of bones is ten inches deep, covering with ashes and again with muck and soil, with a sprinkling of plaster; the whole mass being now and then wet with soap suds.

The alkali of the ashes is said to dissolve the bones, and the muck and plaster will, of course, absorb the gases. Mixing the freshly pounded bones with carbonate of potash, or wood ashes produces carbonate of lime and soluble phosphate of potash, and after six weeks or two months the mass may be used.

If the commercial super-phosphate of lime is suspected of being mixed with old plaster, the hair will be seen; if with oyster shells or chalk, the effervescence and particles of shells will invite closer scrutiny. Sulphates of barytes and lime increase the weight of the mixture. Little is said by the correspondents of U. S. P. O., on the use of phosphates of lime, during the earlier years of the series. In 1853, from Dover, in Delaware, it was stated that the phosphate of lime was used by a few farmers the previous spring for corn, and the result was even better than that from Peruvian Guano. From Berkshire County, Massachusetts, it was stated that the super-phosphate was a new article there, but an establishment for its manufacture had been got up the season previous, and it promised to rank among the most effectual fertilizers. It was said to be fatal to all insect tribes above and below

ground, and to give a cleanly and luxuriant growth, which could not be realized from any other manure. A statement from Mason, New Hampshire, was that the best effect for Indian Corn was found from mixing it with guano in equal quantities. About one hundred pounds of each were applied to a field of corn in the hill, after a light dressing of animal excrements, composted with vegetable matter, had been spread and plowed in; it was a decided success. It was also applied broad cast to a piece of ground for Tuscarora corn without any other mixture. It appeared very beautiful, and where there was a good supply of old vegetable matter in the soil, its growth continued exceedingly fine; but where there was little old vegetable matter, the kernel was not well filled. Another patch nearly destitute of old vegetable matter, but in all other respects well conditioned, was selected for the super-phosphate alone. The growing corn had a healthy color, the growth of stalks was fair, but the grain was not worth harvesting. Not a single well-formed ear could be found. The super-phosphate was also applied to a corn field planted for fodder; one row was left without any; a light manuring of compost had been plowed in; the result in weight was as thirteen and a half to one, and in height, four to one and a half—in favor of the super-phosphate. A Vermonter during the same season applied it to hills of corn before hoeing, with a gain of one-fourth to one-third.

Various commercial manures under the name of super-phosphate of lime, have since from time to time been thrown upon the market, some of which have been analyzed. See Reports of Chemist for U.S. Agricultural Department, 1866 and 1871. In the Department Report for 1871, are extracts from the Massachusetts Agricultural Report, containing some remarks of Dr. J. R. Nichols on frauds in the sale of commercial manures, which are said to be enormous. He presents a formula for a compound fertilizer easily pre-

pared, which he has found highly valuable. He used bone charcoal from the sugar refineries, as a cheap source of phosphoric acid, but says, that burnt bones may be used with fully as good results.

Take nine hundred pounds bone charcoal, four hundred and eighty-six pounds oil of vitriol, and one hundred and seventy-one pounds of water; mix water with acid and gradually add bones, stirring the mass that it may be fully acted on. This affords super-phosphate dry enough to be ground as soon as cool, and it can be ground in a plaster mill. To this add four hundred pounds nitrate of soda, and one hundred pounds muriate of potash in powder, and the result is a ton of fertilizing matter, giving on analysis 14.39 parts in one hundred of soluble phosphoric acid, 27.47 parts soluble phosphate of lime, 2.8 of potassa, 3.14 of nitrogen. Cost of materials at market rates about $44 00. In U. S. Agricultural Report, 1868, is an account of experiments by Mr. Bartlett, of Warner, New Hampshire, on super-phosphates and other concentrated manures for corn, which resulted in a better showing for four of the seven super-phosphates tried than for ashes and bone-dust, hendung, Peruvian guano, fish guano, Cuban, Alta Vela, and Baker's Island guanos, and very much better than for sulphate of ammonia and the French liquid fertilizer. He found that where a fair dressing of manure was applied, phosphates sown broad cast and applied in the hill, increased the crop and very much hastened its ripening. J. W. Clement of Warner, New Hampshire, in 1868 applied the super-phosphate to corn in the hill, one hundred and fifty pounds to acre, after barnyard manure harrowed in, in spring, on cold, wet heavy land, fall plowed, and raised sixty-two bushels of sound corn to acre, at a profit of $43 50 per acre.

SECTION II.

Organic manures necessarily include most mineral ones, which are plant food. They are either of vegetable or animal origin. The former contain more mineral manures than the latter. Vegetable manures decompose more slowly than those of animal origin, and are more lasting in their effects. It has been seen that several of the mineral manures hasten the decomposition of vegetable matter; so does a mixture of animal matter. Certain vegetable as well as mineral matters are of great value in and out of the soil, as preservers of the manurial properties of animal matter.

SUB-SECTION 1.—*Manures of vegetable origin*: (*a.*) The most practicable fertilizer for general use in maize culture, throughout the United States, is a green crop plowed in. This is meant to include old pasture and worn out meadows, or rather bound out, and the natural grass sod as well as the cultivated grass, grain and leguminous, and some root crops. Quite a variety of plants are used in this way in the old and new worlds among grasses; timothy, red top, and the various others mixed in meadows and old pastures; among forage crops, clover, especially the red, is a very general favorite; and in Europe, sanfoin, lucerne, and the yellow lupine, and others. Among grain bearing crops, buckwheat is probably foremost, then rye, oats and maize sown broadcast; of leguminous crops, beans, peas, in the South the cow pea especially, and vetches are highly esteemed for this purpose; among weeds spurry is said to grow so fast on sandy soil that two or three crops can be secured in a season; and of root crops, the turnip is good on all soils, fed out on the land or plowed in. Mr. Wolfinger's article in U. S. Agricultural Report, 1864, is very full and complete on the subject of green manuring. For the maize crop, the mixed grasses and other plants, from long mowing or pasturage very densely

interwoven with the sod, in clay ground plowed under in the fall, and in loamy or sandy soils in the spring, are probably the cheapest and best manure, at least of this kind. From tables of analysis, V, VI and VII, herein, and in U. S. P. O. 1860, pages 53 to 65, it will be seen that these plants contain all the elements of the maize plant in varying proportions, and when decomposed in the soil, abound in food for its growth. They afford most plant food plowed in when in blossom, and it is then most equally distributed through the vessels of the plant, and when turned under will be most equally distributed through the soil; making it spongy and receptive, and retentive of moisture and fertilizing gases, and especially giving it the power of absorbing ammonia from the atmosphere, and perhaps of forming nitric acid. Plants with large leaves like maize itself, and a large system of leaves like clover, buckwheat, peas and beans, draw largely on the atmosphere for ammonia as well as carbonic acid, and these go into the soil when turned under.

The New England Farmer, Volume X, describes three fields (in Delaware) worn out by cropping, plowed up in 1818 and thirty bushels of lime spread to the acre, and two bushels of corn sown broadcast. Early in September the corn was rolled down with a heavy roller and plowed under, harrowed immediately after plowing, and wheat harrowed in early in October, and the crop was nearly equal to that from the fields prepared with stable manure. In Volume V, (1827) a Long Island farmer recommends for farms in the interior, where manure is not easily obtained, the sowing of buckwheat, three bushels to the acre, immediately after the spring frosts, and plowing it when in flower; then sowing a second time, and plowing in when in flower, and if the season admits of it, sowing thick the third time, and the following year putting on the most advantageous crop. The result would probably depend much on the nature of the soil, and it

would be best to ascertain this by experimenting on a small scale. A farmer in 1825, is said to have turned in successively on the same land, a silicious sandy soil, three green crops, rye, oats and buckwheat, and the after crop was very light. In U. S. P. O. 1861 Report, the fertilizing qualities of the yellow lupine as plowed in, two bushels to the acre in North Germany are highly extolled. It grows three or four feet high, and is crushed down with a large roller, or by a strong broom made of twigs before the plowing in, which is during or just after flowering, if sown to grain in fall; but for a spring crop (say maize), it is thought best for it to lay over winter in the field before plowing in.

Deep and long-rooted plants like clover and lupine, where a deep and originally fertile soil has its surface worn out by continual cultivation, bring up fertilizing matters from the sub soil. The root of the lupine absorbs rich phosphates of iron and ammonia of the soil, more energetically than other plants, and dissolves the chemical constituents of minerals, by the evaporation of its root. The lupine communicates its oxygen as ozone, forming in the surrounding air, ammonia containing nitric acid. Succulent plants like clover and buckwheat, make larger veins of carbonaceous matter when decomposed. Among the host of testimonies to the manurial value of clover, is the following from U. S. Agricultural Report, 1870. T. D. T. considers a good clover lay worth as much as five cords of common manure to acre. To insure a good lay, not less than ten or twelve pounds of seed should be sown to acre, on land thoroughly prepared for its reception. Clover not only imparts fertility when plowed under, but its roots divide and break the soil while growing, and cause it to pulverize as they decay. The thicker the plants, thefirmerand better the herbage; the more numerous the roots, the greater the benefit to the soil; both as to pulverization and fertility. On wet low grounds, or very light,

sandy soils, the endeavor to make clover a fertilizer sufficient to redeem them and place them in good condition for corn or wheat would fail.

The cow-pea has been the clover of the South. Planted early in May among the corn crop, and an extra working given, after the corn is laid by, the grass does not overrun it; it yields a heavy crop of vines, and is the best fertilizer applied to clay lands. In old pastures or meadows bound out there is usually so complete a net work of roots, stems and leaves of various grasses and weeds, as when turned under, to divide up the soil to the best advantage, and fill it with the needed fertilizing matter, developing according to the requirements of the growing corn. Hence the very general resort to this preparation for the maize crop. Turned under in the fall or winter, it is most thoroughly ready for the young plant, and may give it the best start. Turned under in spring, it may make the complete filling out of the grain more certain. The former is said to be the best for clay soils, and for ridding the ground of the cutworm; the latter for soils warmer and more easily penetrable. Prairie sod plowed shallow at first, is said by some to decompose in better time, but most soils are better turned under deep. In new and very fertile soils, this system of manuring is usually sufficient for full crops and often for the largest; on older settled or long cultivated farms, and especially on up-lands, barn-yard manure, plaster, lime or ashes are frequently added.

(*b.*) The stubble and weeds of a small grain crop are sometimes turned under very early in the fall, with advantage, as well as those of a maize sod crop. This gives an opportunity, on land comparatively level, for a fall top dressing of barn-yard manure. The weeds of a maize crop, during after culture, may also help out the manure, and those hoed out, if piled in the passage ways and sprinkled with quicklime, may swell its bulk to advantage.

(*c.*) Waste straw and stalks, spoiled hay or fodder, pea and bean vines, potato vines, cabbage leaves, and refuse of other plants, forest and other dead leaves, pine shatters, rotten wood, refuse chips from the wood house, carpenters' and turners' shavings, saw-dust, (hard wood saw-dust is the best absorbent), and other vegetable refuse matter should be carted in the fall and other spare times to the barn yard or hog-pens, or sheep pens, or stables for horses and cattle, and spread over the floors as a bedding, as well as absorbent of the liquids and gases from the droppings of domestic animals. In this way they will be of great service in increasing the carbonaceous and saving the nitrogenous matters for the soil.

(*d.*) *Muck or peat* is formed mainly by the accumulation in sunken places, especially in hilly countries, of waste vegetable matter, (not taken up in basins and meadows), mixed with insoluble earths. The elements vary with the vegetable growths in the vicinity; also with the prevailing soil of the bog and its surroundings. Rains and streams are the carriers which supply the material.

When forest leaves, dead brush, weeds and decayed wood are the sources, it is mostly carbonaceous. A stream passing through the bog is apt to leach away the more soluble fertilizing matters, unless there is sufficient humus in the soil to detain them. If the soil is clayey, or has a clay sub-soil, a greater accumulation will be apt to take place. Where there is standing water, vegetable acids, such as carbonic, humic, crenic and hypocrenic, are often formed, and often combined with minerals. The wash of clay beds frequently contains iron as bog ore; and the sulphate of alumina is decomposed, setting free the alumina, the basis of clay, while the iron combines with the sulphur as sulphuret or pyrites; and it may so abound as to injure the fertilizing qualities of peat. An abundance of any of these acids in a manurial substance makes lime or some other alkali necessary as a corrective.

Mixed with quicklime it rises into a light and pulverulent mass. The lime also takes away the acids from the iron, forming salts of lime, the elements of many plants. Muck, with little or no acid, may be used advantageously on sandy soils, or such as are deficient in organic matter. It makes a very effective compost with barn-yard manure, guano, ashes or animal matter. It absorbs the gases evolved from these substances when putrefying. It is a good deodorizer and diluent of night soil, retaining all its fertilizing qualities and making it easily and safely applied. After being dug up in autumn, (if practicable in large quantities), muck should be exposed to the winter frosts; for composting with lime or ashes, may be used the following spring; for composting with stable manure or night soil, it should be taken from the heap in autumn, after laying a year, to the barn cellar for periodical mixing with the droppings of animals, and in sufficient quantities for free use as a deodorizer about the premises. Good muck may be applied in corn culture, equally mixed with barn-yard manure. Carbonaceous manures are largely derived from vegetable composts, animal excrement and muck. They are mixed and compressed into commercial manures. Marsh mud is one of the mucks. A full discussion of the value and uses of swamp muck will be found in U. S. P. O. 1856, pages 182 to 198.

(*e.*) *Charcoal,* powdered fine, is nearly pure carbon, and one of the best deodorizers of night soil. Peat charcoal is highly antiseptic, operates very readily in disinfecting vaults, and absorbs enormous quantities of ammonia and other gases. In 1856, it was said only to be made at the North. Wood charcoal dust is very effective in the same way, though said to be inferior to peat charcoal. Scattered in stables as an absorbent, it is very useful. DeSaussure found by direct experiment, that the charcoal from boxwood absorbed in twenty-four hours and retained in its pores ninety times its volume of ammoniacal gas.

(*f.*) *Soot* has long been highly esteemed as a powerful manure. Davy describes it as possessing ammoniacal salt, empyreumatic oil and charcoal capable of being made soluble by oxygen or vital air. It may be sown dry with the seed it fertilizes, but goes farther mixed—six quarts of soot to a hogshead of water. One hundred pounds of soot are said to contain as many valuable manurial elements as a ton of cowdung. Common salt combined with soot is a great fertilizer.

(*g.*) *Seaweed* is much used on the Atlantic coast. From Barnstable County, Massachusetts, it was reported in 1851, that taken from the shore and turned under, it was a most valuable manure, but its value was greatly increased by carting it into the barn-yard or hog-pen, mixed with mud or muck, and leaving it a few months before application.

(*h*) *Cotton Seed* is extensively applied to corn fields in the Southern United States. A South Carolina correspondent in 1850, describes it as being dropped in the furrow, on both sides of the grains of corn, at planting, and covered with one shovel and two small scooters, or harrow. Another, writing from Marion county, Mississippi, advises to sow it on the land in January, twenty or thirty bushels to acre and plow under; thus sown it will be sufficiently decomposed to supply the crop as soon as the corn is up; he states that in the hill it only gives good crops in fine and uniform seasons.

(*i.*) Spent tanbark has sometimes been used as an absorbent, but it is probably better as a mulch.

(*j.*) Tobacco dust, from the alkali contained in it, was, at a discussion by the Institute Farmers' Club, in 1869, stated to be a good manure, worth to the farmer $20 per ton.

SUB-SECTION II. *Manures of Animal Origin* are a very extensive class.

(*a.*) *Dead animals.* Of those floating in the atmosphere as insects and birds, which die fast, and help to cover the

earth with graves, the number is immense; but the scavengers are so abundant, that ordinarily but a small portion of them find their way into the manure heap. In well developed agricultural regions wild animals are scarce, and are generally shot down and consumed as game. Most dead animals that help out fertilization are domestic, or at least tame ones. Horses and cows, hogs, sheep and chickens, are often drawn or thrown out, where their decomposition will be least injurious to the health of the community, and the dogs devour them because their owners have no use for the manure, into which, by proper management, they might be converted, or because they want the skill or conveniences for thus disposing of them. Sometimes poisonous matter from a dead animal proves fatal to the person employed to remove the hide. Thick gloves should be worn in the act of handling the carcass, or the hands smeared with something that will prevent contagion. If the carcass were cut up in moderately sized pieces and buried a foot deep, with a covering of muck, finely pulverized clay or garden soil, and these deodorizers mixed from time to time with the decomposing mass, there would be some probability of converting it into a good fertilizer. Among the gases evolved during this process of decomposition, are ammonia, and sulphuretted and phosphoretted hydrogen. Where muck is obtainable, it has been recommended to cover the dead animal six inches with it, and let it go on decomposing six months or a year, throwing out the bones after summer is over, and giving more earth and some plaster to the over-hauled mass, which after another month or two may be worked into corn land with great advantage.

(*b*) Certain kinds of fish on the New England and Long Island coasts, not valuable for human food, are used fresh; one or two in a hill of Indian Corn, being slightly covered with soil and the seeds dropped on it. So fish offal is carted inland from Chesapeake Bay in Maryland, and from the

fisheries on the Potomac, Delaware and other rivers in large quantities by the farmers. The New England Farmer for June 16, 1826, stated that at River Head, Long Island, nine millions of moss bunkers were taken in three weeks for manure. Fish deodorized by composting with peat, during putrefaction, are capital fertilizers. A writer in Ohio Agricultural Report 1862, gives an extended account of the fish guano manufacture in Northern Europe, and recommends the same for the Lake Erie Coast, there being a great abundance of unsalable fish in that lake. The method of an English firm was to place the unsalable fish and offals from herring fisheries in a large basin, where it was decomposed and reduced to jelly-like substance, by pouring on it sulphuric acid, and then in a centrifugal drying machine deprived of its fat, and completely dried and ground to powder. Pulverized charcoal might be added to absorb the manurial substances in the watery parts thus removed. Steaming may be substituted for the use of sulphuric acid. Experiments have been made in Germany with the Norwegian fish guano with marked success, and Dr. Vohl in Bonn states, as the result of his own analyses, that the bones of fishes are a rich source of phosphatic and mineral matters, and their flesh and gelatinous tissues are rich in nitrogen. The ammonia is not ready furnished in fish guano, but is gradually produced from the albuminous and nitrogenous tissues during its putrefaction in the soil, and at the same time it loosens up the soil by developing carbonic acid. Menhaden fish at certain seasons are taken in large quantities, steamed and subjected to strong pressure, which forces out the oil, and the residuum, being nearly as dry as seasoned wood, is ground and barreled for market as poudrette.

(*c*.) *Blood* and other matters as well as night soil are dried and deodorized by mixture with absorbents of ammonia, phosphoretted hydrogen and other gases and moisture, pow-

dered and sold as poudrettes. These are very rich when rightly made. Applied in the hills of corn, sprinkled over a surface of ten or twelve inches square, and covered deep enough for the retention of the gases evolved by their rapid decomposition, they give the plant a fine start and early growth, warming up cold soils, and making up for backward seasons.

(*d.*) The manurial value of bones in connection with the phosphates has already been discussed, but ground bones or bone dust have another fertilizing element in their gelatin and other organic components. Two hundred and sixty pounds of bone-dust, less than six bushels, have been said to supply phosphates enough for an acre of ground, in crops rotating for four years, as turnips, barley, clover and wheat. These may be saved also by immersing the bones, till softened into a paste, in a mixture of one pint of sulphuric acid with two pints of water, and then mixing them with dry muck or something that will take up the adhesive particles. Or a strong steam box hung on a frame, so as to be easily turned over, has a square hole cut through one of its sides, and a cover tightly fitted with clamps and a screw; through this hole the bones are crowded, the cover closed and super-heated steam admitted for several successive hours. Part of the separated gelatin is conducted away to ferment in contact with dry muck, and with the addition of some dissolved bone, forms *ammoniated super-phosphate of lime.* From the well soaked mass in the steambox, the cover is removed, and the overturned box emptied on the floor; the contents carried by machinery, to a steam heated room above, and dried and ground. Bones are sometimes decomposed by being thrown into a hole with fermenting manure, or decaying dead animals from three to six months. They are too valuable to be wasted.

(*e*) Waste feathers and hair, waste of hides and scrapings, leather parings, old shoes and rags may all be economized for

manure. Rasped horn is decomposed in the ground without further preparation; but more effectively by softening it in caustic lyes without raising the temperature, and adding diluted sulphuric acid to neutralize the alkali. Of woolen refuse, ten or twelve hundred weight per acre have been applied to grain crops on light, chalky soils in England.

(*f.*) *Excrements of domestic animals.* Those applied to maize crops are chiefly cow, horse, mule, sheep, hog and hen manure. The first five are not essentially different from those of the rarer domestic animals. Rabbit dung and excrements of deer, are among the recorded fertilizers of England. Those of the buffalo are a well known article of fuel on the Great Western plains, and no doubt do help to fertilize their grasses. By far the most important sources of excrementitious manures are pastures and barn yards of farms, and stables and streets of cities. Guano beds are more excellent in kind than in quantity. The higher animals are fed, the richer is their manure, especially in nitrogenous properties. The following table (U. S. Agricultural Report, 1861), shows the results found by Boussingault as to manures voided in twenty-four hours (in grammes):

I.

	Fresh.		Dry Matter.		Nitrogenous.		Salts and Earths.	
	Urine.	Excr't.	Urine.	Excr't	Urine.	Excr't.	Urine.	Excr't.
Horse......	1,330	14.250	302	3.523	37.8	77.6	110.0	574.6
Cow........	8,200	28.413	960	4,000	36.0	92.0	38.4	480.0
Swine.....	3.050	1,380	63	208	6 9	9.2	31.2	84 4
Man.......	1,200	150	40	38	8.6	1.5	9.7	9.0

It will be seen how large a proportion of plant food there is in the urine. Though the fresh excrements of the horse, cow and swine greatly exceed the urine, the dry matter differs less, and the nitrogen still less.

The following from same volume shows the most important nutrient elements in the ash of manures:

LI.

	Horse.		Ox.		Swine.		Man.	
	Urine.	Exc't	Urine.	Exc't	Urine.	Exc't	Urine.	Exc't
Lime	6.80	4.03	.67	5.71	......	2.03	1.15	26.46
Magnesia	4.78	......	3.93	.....	......	......	1.34	10.54
Potash	30.62	11.30	59.18	2.91	8.03	3.60	13.64	6.10
Soda	13.24	1.98	0.98	0.98	13.00	3.44	1.33	5.07
Common Salt.	6.94	0.03	0.30	0.23	53.00	0.89	67.26	4.33
Phosphoric Acid	.00	1.40	.....	4.20	10.00	4.90	11.21	36.03
Silicic Acid	.55	62.40	0.35	62.54	......	13.19	.00	0.00
Sulphuric Acid.	6.01	......	6.30	......	3.00	......	4.06	3.13
Earthy Phosphates	......	......	......	......	8.80	......	......	......

Dr. Voelcker's researches as to barn-yard manure in England proved, first, that the manure exposed to the weather loses the principal part of its assimilable plant food; second, that the washings from it contain a very large part of this food. American farmers are liable to greater losses by washing, because their rains are more violent, and their buildings less skillfully arranged. As barn yard manure has usually a large element of waste vegetable material, fermentation, either before or after application, is required to make it ready for plant food. The composition of street and road manures and the sweepings of houses, is the result of a mixture of various substances, and these are usually applied unfermented; modern roads in and near cities being very generally covered with comminuted limestone, which would probably be a sufficient solvent, especially when incorporated in the soil. Barn-yard and pig manures are very extensively used in the agriculture of the United States, especially for maize culture. The correspondence of the U. S. P. O. from 1849 to 1853 shows how large a part it takes in keeping up the fertility of soils, especially in the older agricultural States. They seem to have become more of a necessity from the application of other manures.

First as to the modes of saving manures from domestic animals. The simpler modes of pasturage, especially with sheep, and the hogging down system, have been referred to herein; also the carting of horse manure from the stables direct to the field intended for corn to kill the grub-worm. Where one has not the better conveniences for saving manure, this method has other advantages. Deposited on corn ground in large heaps in the fall, and these covered with muck or soil, they lose but little of their fertilizing qualities during the winter months. In spring early, as soon as the frost is out of the ground, and before the heaps get hot, they may be overhauled and sprinkled with plaster or other absorbent of ammonia. Plowed in just before planting, the decomposition will be sooner completed, giving the young plant more of a start; harrowed in after plowing, the manure operates more as an absorbent of ammonia from the atmosphere. Plowed in, in the fall, on clay ground, the winter's freezing and thawing would so pulverize the soil, that the manure, as it became decomposed, would be too thoroughly incorporated with the soil, to suffer much from leaching, even on hillsides, if deeply turned in with a side-hill plow. An early planting and rapid working would seem important in this case, to realize the full benefit of the manure. Where the surface is tolerably level, it might be better to spread long manure on plowed ground in the fall, if the soil is somewhat porous. Replowed shallow, or harrowed just before planting, it might feed the plant better in its later growth. Many farmers find an advantage in so arranging their buildings, that what manure, solid or liquid, is carried off by running water, will pass over the fields intended for tillage. These will take up most of the fertilizing matters. A broader economy may be the result of so excavating the barn or cattle yard, that all the liquids may run into it towards one centre, where refuse straw, corn stalks, and other vegetable waste may be

deposited to take up the fertilizing liquids and gases, and the moisture that softens the woody fibre. After being worked up by the feet of the cattle, it may be removed to a pile under cover, or carted (plaster or muck being sprinkled as it is loaded), to well protected heaps in the field. When the pile near the yard is roofed over, a few sheep or hogs may be kept on it as it is gradually increased; it being thus saved from overheating or freezing; absorbents being periodically sprinkled or spread over it. In the winter it may be sledded out to large heaps in the fields, or in spring hauled out to where it is wanted.

But the best arrangement, if it can be afforded, is probably the barn cellar. This should be right under the stables, so as to catch the fertilizing liquids; should be of adequate height; have a water-tight floor, to be covered five or six inches deep with prepared muck or other absorbent; the walls should be of stone or brick well pointed; it should be sheltered if possible from high winds, and be secure from winter freezing. The excrements of cattle, mixed with litter, daily strewed over the floors, and sprinkled with plaster or other absorbent of ammonia, are regularly thrown down, and the liquids find their own way there, to keep the mass sufficiently moist for gentle fermentation all winter long. It is very important to stow away in summer and fall, enough of muck, where it can be mixed daily with the fresh dung, for the whole winter. To prevent excessive fermentation, the temperature must be well regulated. When spring makes all ready for another maize crop, the ripe contents of the cellar are hauled out to the fields and spread on sod or stubble and plowed in, or on the furrow, and harrowed or worked in with the cultivator; the best rotted manure being by many reserved for the hills at planting, a shovel-full, more or less, in each. In some places, if the seed is drilled in, the drill furrow is filled with manure, which with the seed is covered with a light plow.

The quantities applied, as stated by correspondents of U. S. P. O. 1849 to 1853, are variously estimated in ox cart or wagon loads, say ten to twenty, twenty or thirty, or more; or in cords, six in one instance being equal to twelve loads. In a few cases the number of bushels to each load is given.

Hen manure, properly saved, is one of the most powerful in its effects, being a combination of the urine and excrement of fowls. Like other bird manure it contains uric acid; gives out carbonate of ammonia by distillation, and dissolved in water, yields soluble matters. It is very apt to ferment. The instinct of hens to roost in the same place makes it very convenient to save their droppings. Roosting poles under cover should be extended for them; and muck, dried clay powdered, coal ashes, or garden mould, should from time to time be thrown underneath to receive the droppings. The mass should be left undisturbed till shortly before it is applied, when it should be turned over and well mixed; or if it must be disposed of sooner, the mixed mass may be deposited in boxes or barrels. In one case where thirty loads of other manure were applied to the acre, the droppings in each hill, as much as one could take up in his fingers, of hen manure made during the year, caused a gain of sixty per ct. for a potato crop. What has been said of hen manure is probably applicable to that of domestic fowls generally.

(*g.*) *Pigeon dung* has been described by Loudon as very much like that of domestic fowls. It should be applied as new as possible, and wet or dry, may be used like other manures capable of pulverization. The forests loaded with the roosts of wood pigeons, doubtless manure heavily the soil of their haunts. The droppings abound in ammonia, and help to dissolve the waste of leaves. This manure has long been highly prized in Persia.

A farmer raising a number of fowls (1859), found that in a single night a pigeon produces seven and one-half grammes,

a chicken fifteen, a duck twenty-two and one-half, a goose or turkey, thirty and one-fourth.

(*h*) *Night soil* is the most powerful of our domestic manures. This is due to the variety and richness of human food and the soluble form in which it is used. It decomposes very readily, and its elements vary with the character of the food, but it always abounds in compounds of carbon, hydrogen and nitrogen, and whether fresh or fermented, is capital food for plants, but not lasting in its effects. In its natural state it contains about three-fourths water, with volatile ammonia, carbonic acid and sulphuretted and phosphoretted hydrogen dissolved in it, which escape by evaporation or otherwise. Hence the failures in deodorization and in making poudrette. The solid part of night soil, dried so as to retain the gases is very fertilizing and stimulating, and, says Boussingault, worth ten times its weight of farm-yard manure. The use of night soil in China has kept up its population for long ages. Plaster, muck, copperas, and powdered charcoal have been used as deodorizers and absorbents for night soil and urine, but the finely powdered clay or dried loamy soil, recommended by Rev. Mr. Moule of England, is probably best. The Chinese were said to use the former of old. Mr. Moule finding his vault likely to be a nuisance, buried in the earth the fresh night soil from his premises, deposited in small vessels, and after a short time found that all traces of it had disappeared. This led him to try the effect of mixing the daily deposits of the vault with dried earth or powdered clay, kept under cover for the purpose, and he found the deodorization complete. After some time the same material regained its absorbing without losing its fertilizing power, and could be used over again. He proceeded to invent various conveniences for the disposition of manure thus provided, which are described in his work published on the subject, and also in U. S. Agricultural Reports. Night soil is usually applied in the

hill with muck, plaster, coal ashes or other diluent. Dried and well preserved as poudrette, it was said in 1852 to succeed very well on light soils in Windham County, Connecticut, and was thought cheap at two dollars per barrel.

The simplest method thus far suggested of composting night soil is to drop peat or loam daily on the deposits in the vault. Some carry it out in the fall and mix it with other manures.

(*i.*) *Liquid manures* abound in fertilizing matters, and are very easily applied; they have long been used in Europe. Loudon describes their use by the farmers of German Switzerland. They are obtained from stalls and stables, and collected into underground pits or reservoirs, in which they are allowed to ferment in a mucous or slimy state. In Zurich the floor on which the cattle are stalled, is formed of boards with an inclination of four inches from head to hind part of animal, whose excrements fall into a gutter behind, in the manner usual in the English cow-houses. This gutter is fifteen inches deep, and ten inches wide; receives at pleasure water from a reservoir near it, and empties into pits by holes opened or closed. The pits, laid in well cemented masonry, bottomed in well beaten clay, are covered with a floor of boards placed a little below that on which the animal stands. This covering facilitates the fermentation. It should be so that the liquids be not disturbed during their four weeks fermentation. The capacity of the pits should be such, that the number of the animals the stable holds may fill one pit in a week. The pit must be closed at the week's end, whether full or not, so as to be emptied systematically by portable pumps. In the evening the gutter receives its quantum of water, which in the morning is so mixed with the excrement fallen into it, as to form an equable and flowing liquid. If this is too thick, the fermentation is deficient, if too thin, there will be too little nutrient matter. The mixture is allowed to run off into

the pit beneath, and water is again let into the trench. During the day when the keeper enters the stable, he sweeps whatever excrement may be found under the cattle into the trench, which may be emptied as often as the liquid attains a due thickness. Best mixed three-fourths water to one-fourth excrement, if the cattle are fed on corn; if being fattened, four-fifths water to one-fifth excrement is sufficient.

Another method is to sink five tubs or large earthen vessels in the ground, and let the contents of the portable receiver of the water closet, with all the water used for washing in the house, soap suds, slops, and fermentable offals of every description during a week, be carried and poured into one of these tubs—and if not full on Saturday night, let it be filled up with water of any kind, well stirred up; the lid replaced, and the whole stirred up for a week. Begin on Monday morning with another tub, and when after five weeks the whole five are filled, empty the first at the roots of the growing crops and re-fill. Or use two larger tubs and continue filling one for a month, empty the first, and so on.

Some crops bear the application of human urine better than others, and well grown plants, as peas and tomatoes, very much better than young ones. Great caution should be used in experimenting with such powerful fertilizers. Testimonies to their use on the maize crop by correspondents of U. S. P. O. are infrequent. For sprinkling pastures, (the eventual food of maize crops) liquid manure carts are often employed. The possibility of utilizing for manurial purposes, the sewerage of cities, as extremely important to the future of grain production, has been much discussed by leading agriculturists in Europe. The subject is hedged in with difficulties. These have been measurably overcome by the dense population of the far East. As it is, vast quantities of these fertilizing matters go to fill up the ocean; and probably vast quantities of the most fertilizing gases, are floated back with the evapo-

rated oceanic waters to the cultivated fields of the old and new world. How far contributions from the richness of the land help to swell the finny population of the deep, it is of course impossible to determine; but fish are fast becoming a source of rich fertilizers, and some of the richest commercial manures are supplied by birds living wholly on fish.

The author of the "Advice to Europeans," (for the preservation of those residing near the sea in hot climates, 1768), remarks, "that by a peculiar blessing of Providence, not only the river Senegal, but all the great rivers whose sources are within the tropics, have deposited by their annual inundations, great quantities of slime and mud at their openings into the sea; which form what are called the bars to those rivers. Those bars, or shoals, consisting of a fine, soft ooze, often extend themselves many miles from the land, and afford not only a safe anchorage for both the floating factories and infirmary ships, but they abound also with an incredible quantity of excellent fish; and one man in the infirmary ship, lying off Senegal, or in most other places on the coast of Guinea, will be able to catch as many fish of different sorts in two hours as will be sufficient for the nourishment of a hundred sick people." He adds, (showing the probable immense consumption of fish as human food, and the consequent return of oceanic manures to the land), that, "it has been found by experience that no food whatever contributes more to the perfect recovery of health and strength, and to the prevention of the fatal consequences of fevers in hot climates, than fish, or rich nourishing fish soup, warmed with the spices of the country, and if necessary, rendered palatable by the addition of lime juice."

Guano is a mixture of the excrements of sea birds with the remains of some of their dead bodies, generally on desolate islands, suited for their roosting and breeding places, and piled up through the long centuries in dry climates. In

birds the secretions both of the kidneys and intestines, are mixed in the cloaca. They greatly differ in composition; in rainless districts, say at Chinchi, Ilo, Iza and Arica, fifty vessels being said in 1839, (the date of Murray's Encyclopedia of Geography), to be laden annually with it at Chinchi, carrying from 1,500 to 2,000 cubic feet; the West coast of Peru being rich in both the ammoniacal salts and the phosphates. In 1865 its deposits in South and Middle Peru were reckoned at more than twenty millions of tons. It is much richer in nitrogen than the droppings of birds living on vegetable food. The U. S. Agricultural Report for 1865, gives from Prof. Norton, the following composition of four principal guanos:

LII.

	Water.	Organic matter and ammoniacal salts.	Phosphates.
Bolivian	5 to 7	56 to 64	25 to 29
Peruvian	7 to 10	56 to 66	16 to 23
Chilian	19 to 13	50 to 56	22 to 30
Ichaboe	18 to 26	36 to 44	21 to 29

The Ichaboe coming from a moister climate than the West coast of South America, contains more water, and is more decomposed, giving a stronger smell of ammonia. The Pacific guanos however, mixed with a little quicklime and gently heated, yield a very pungent odor. Later guanos, discovered by Americans, come from the Baker and Jarvis Islands, containing, according to Liebig, no uric acid, little of nitrogenous substances, potash, or magnesia, but being more like bone dust; Baker's containing fully eighty per cent., and Jarvis thirty-three of phosphates, and the latter forty-four per cent. of gypsum. They are more soluble than other guanos, and the farmers can quicken their action by adding twenty to twenty-five per cent. of their weight of concentrated sulphuric acid, making them super-phosphates. Mexican gua-

nos have less ammoniacal salt, and more phosphates than the Peruvian, making plumper grains but less straw. Voelcker's analysis showed one pound of guano, equal to fifty pounds of barn-yard manure, and more convenient of application, being often put in after planting. Good guano twelve years ago would have had a large sale at $40 to $50 per ton. It has been adulterated with gypsum and umber. Professor Johnston says the drier and lighter colored it is, the better; it ought to smell strongly of ammonia, when a spoonful is mixed with a spoonful of quicklime in a glass; and when well stirred with water in a tumbler, and the fine matter poured off, should leave little sand or stones. The ammoniacal guanos are the most immediate, the phosphatic the most permanent aids to plant growth. Three hundred or four hundred pounds of pure guano are thought to equal fourteen to eighteen loads of common manure. A Massachusetts farmer made three hundred pounds guano increase the maize crop fifteen bushels per acre; in another instance $53 00 worth of guano yield a profit of $77 00, and again, two hundred and fifty pounds sown to acre, increase the crop twenty bushels to acre. Guano in 1849, though expensive, was fast coming into use for corn in Delaware County, Pennsylvania. Eight hundred tons had been used in that year in Montgomery County, Maryland. In 1850 a Rhode Islander tried it on Indian Corn for soiling; the land in good tilth; on June 6th, thirty loads of barn compost to acre, plowed under and harrowed deep, and on June 8th furrowed deep for corn drills; into one portion six loads of barn compost were dropped, and two and a half bushels of Southern maize to acre, and covered. Over another portion he strewed guano compost, (three hundred and twenty pounds guano to acre), and covered lightly, and then covered in the same quantity of Southern corn to acre. June 16th, the guanoed rows were well up, and the manured rows hardly visible. During the whole season the guanoed rows were ahead in ver-

dure, height and size of stalks. The whole field was blown down in July, the guanoed portions most injured, making it necessary to cut them prematurely in mid-August. A square rod of each of the rows side by side, was weighed green, the guanoed, four hundred and fifty pounds, the other, three hundred and sixty-five—gain per rod from guano, eighty-five pounds. In 1851 the yearly consumption of the Peruvian in the United States was fifteen thousand tons, chiefly in the Middle States, where it had recovered many worn out farms. Correspondents of U. S. P. O. 1851, from Windham County, Connecticut, wrote of its use there with the best success, but in limited quantities owing to high prices; and in Litchfield County, a little was put in the hill at planting or first hoeing; in Sussex County, Delaware, three hundred pounds to an acre were plowed in six inches deep; another sowed two hundred pounds Peruvian and three hundred Patagonian to acre, on corn and wheat with much advantage, but with a protest against its high price; in Harford County, Maryland, it was applied to corn land generally before flushed, and after planting, sown on the furrow and harrowed in either way; three hundred pounds to acre doubling the crop; the average being thirty bushels to acre. In Fairfax County, Virginia, it stood No. 1. though costly, being quick and certain on all crops; in Amherst County, Virginia, two hundred pounds per acre increased a three barrel maize crop to four or five barrels; in Buckingham County, Virginia, its use was general and favorable; applied to corn by dropping into the furrow as much as could be taken up with the thumb and two fore-fingers, and earth drawn over it with the foot. Guano was too costly for small farmers. Another correspondent from the same county found it unsafe for a summer crop, and in dry weather injurious. He sowed it down and turned under with a three horse plow. In Southampton County, Virginia, guano on corn land produced varied results. One of the most successful farmers

finding not the slightest benefit from the application of half a ton to part of his last maize crop. In Macon County, Tennessee, it was a success.

In Europe, according to Loudon, it was long ago applied to maize crops in large quantities. In 1851 for general purposes, Great Britain imported it to the value of ten million dollars. In South America it has long been highly prized as a fertilizer. It is best applied in damp or showery weather, and mixed with five or six times its weight of charcoal, fine soil or dried muck; if applied to land just plowed, should be immediately mixed with the soil by harrowing or brushing, should not be allowed to touch the seed, and should be applied with reference to the present crop only, and not to benefit succeeding crops. Professors Hembstadt and Schubler experimented with different manures to ascertain the quantity of vegetable substance produced in proportion to the seed, with the following result: No manure, three times; herbage, grass, leaves, &c., five; cow dung, seven; pigeon dung, nine; horse dung, ten; human urine, twelve; sheep's dung, twelve; human manure or bullock's blood, fourteen.

Bat guano is described by the chemist of U. S. Agricultural Department in the monthly report for May and June, 1876, as the excrement of the bat, deposited in caves in Virginia, Kentucky, Tennessee, Alabama, Arkansas and Texas, of which samples were sent for analysis very similar in appearance, except those containing a high proportion of insoluble mineral matter. Six of the samples had on analysis, of organic volatile matters in one hundred parts, respectively, 46.77, 82.18, 58.439, 47.73, 92.745, and 6.144, with variable small proportions of sand, clay, alumina and sesqui-oxide of iron, soluble phosphoric acid, lime, magnesia, sulphuric acid, chlorine, nitric acid, potassa, soda, soluble silica, organic nitrogen and ammonia; and moisture from 2.59 to 44.33 parts. Their physical condition when air dried

was excellent, both for handling and for application to the soil. They were valued at $15 00 to $55 00 per ton. Saltpetre was made from several of these caves during the late war.

The farmer will find it to his advantage to use all the available manurial matter about home before he buys; especially before he buys imported manures. And when he does he should buy intelligently. An article in U. S. Agricultural Report 1861, on the philosophy and chemistry of manures, aims to lead him in the right track. We extract a few figures giving a general idea of the value of several sources of nutrient elements for plants—sulphate of ammonia has 18 to 20 per cent. of nitrogen; soda saltpetre 14 to 16; dry blood 10 to 12; horns of cattle 9 to 11; leather 6 to 7; hair from tanners 5 to 8; wool offal 4 to 6.

LIII.

	Nitrogen. Per cent.	Bone Phosphate. Per cent.
Peruvian Guano	12 to 15	20 to 28
Fish Guano	7 to 8	28 to 33
Bone Dust (fresh bones)	4 to 4½	45 to 50
Bones after loss of Glue	2	50 to 60

Professor Johnston estimated nitrogen per pound seventeen cents, soluble phosphoric acid twelve and a half cents, insoluble phosphoric acid four and a half cents, potash per pound four cents. These numbers will give a general idea of the value of manures, if we have an analysis of them. Thus a manure which in 100 pounds would contain of

Nitrogen, - -	2	lbs. would be worth		17x2=34 cts.
Soluble phosphoric acid, -	4	"	"	12½x4=50 "
Insoluble " " -	10	"	"	4½x10=45 "
Potash - - -	8	"	"	4x8=32 "
Sand - - -	76	"	"	0x76=00
	100 lbs.			$1 61

In the absence of analysis, better buy from responsible houses of known reputation for honesty.

CHAPTER XIV.

THE PLOW

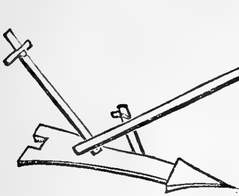
Is one of the earliest inventions. The oxen were plowing when the Sabeans fell on Job's servants. Moses forbade the tackling together of the ox and ass for plowing. The Israelite of Samuel's time went down to the land of the Philistines to sharpen his coulter. Elisha was plowing with twelve yoke of oxen, when Elijah threw over him his mantle.

(*a*) Some suppose the invention of the plow coeval with the first raising of grain, say in Egypt. Loudon asserts that antiquarians are agreed on the pick as the first form of the plow. A medal of the greatest antiquity, dug up at Syracuse, contained the impression of a pick, and another relic a pick-like plow drawn by two serpents, and the like may be seen in various ancient medals and drawings.

(*b*.) Hesiod the Grecian agricultural poet, who wrote about the tenth century B. C., advises the farmers to have two plows, for security against accident; one having the share, beam and plow tail, one piece of timber; say a young limb with two branches from it proceeding in opposite directions; the main limb was used for the pole, the branch at least angle was the share, sometimes shod with bronze; the other at an obtuse angle stood upright for the plow tail or handle. Hesiod's other plow was in three parts; the share of oak, the draft pole and plow tail of elm or bay firmly nailed together. Some suppose it the one still used in Southern France, others, the recent plow of Magna Græcia, and Sicily, which are old Greek colonies.

The annexed cut (figure 1) represents the recent plow of Magna Græcia. See also figure 2.

The holm oak was said to have a natural curvature fitted to the making of Hesiod's plow. In Virgil's time a tree was forced into the right form. Virgil's plow seems to have had earth boards or a mold-board rising on each side, and adjusted to the share, and bending outwardly to throw each way the soil previously loosened and raised by the share. The Roman plow as described by Pliny, had a colter like ours, and in his time two wheels were added. Cato had a plow for strong soils, and another for light ones; Varro, one with two mold boards, to ridge up after sowing the seed. The Romans had plows with and without mold-boards; with and without wheels; with and without a colter; with broad and narrow shares; and plow shares with sharp sides and points.



[FIG. 1.]

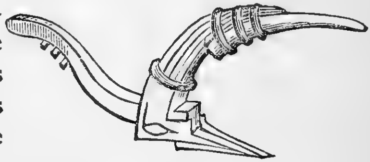
(*c*.) To recapitulate, the first plow was a crooked stick of sundry shapes, operating like a double mold-board; next the plow point was shod with iron; then a land side was made by hewing off one side of the stick so as to throw the earth only one way; then the plow became a simple wedge, the land side being nearly parallel to the plow's motion; the other side moving the furrow to the right, but leaving the furrow to stand on edge. Then the wedge was gradually twisted so as regularly to invert the furrow.

[FIG. 2.]

(*d*.) One of the early laws of Wales was that no man should undertake to guide a plow until he could make one,

and that the driver should make the ropes with which it was drawn, of twisted willows. Societies were formed for making them and proving with oxen. The Norman conquerors of England had a wheel plow, with one handle held in one of the plowman's hands, the other hand grasping an implement for breaking the clods.

(*c.*) The Orientals are famous for holding on to their old customs. The plow of Hindostan was little better than a pointed stick, and was carried on the plowman's shoulder to the field like a spade. It scratched sandy uplands or river mud tolerably, but on the strong lands of Bengal, only a few of its scratches could now and then be seen, the ground being plowed from five to fifteen times, till mould enough was raised to cover the seeds. In Ceylon, Indian corn was cultivated in low flat swamps, admitting of being flooded with water. Some of the Chinese plows were drawn by women, others by a single ox or buffalo. The driver of the plow of Erzeroum stood on the share to press down its wedge, and was carried along with it. The plow of the Morea had a share like the claw of an anchor, the edges being armed with iron; it sometimes had two wheels; it was drawn by one horse, two asses, or by oxen and buffaloes, according to the soil. A traveler in Poland saw a plow drawn by a cow, she being tied by her horns to the trunk of a young fir tree, one of the roots sharpened for a share, another used for a handle; the driver being his own plow-maker. The corn plow of Castile in Spain, which was supposed to be as old as the times of the Romans, was described by Townsend as having a beam about three feet long, curved and tapered at one end, to receive an additional beam of about five feet, fastened to it with three iron collars; the other end



[Fig. 3.]

of the three foot beam touching the ground, and having a mortice to receive the share, handle and wedge.

(*f.*) The Greek and Roman plows seem to have held their own in Europe with little change, till the Dutch and Flemish began to improve them in the sixteenth century. The English made further improvements in the seventeenth century. The author of a "Tour to Killarney," in Ireland mentions a place where the plow was unknown, till the clergyman introduced it, when immense crowds flocked down from the neighboring mountains to see its operation, which struck them with wonder, but when the people were reminded that their fore-fathers were *diggers* of the soil, they shunned the sight of the new instrument, and unanimously resolved to stick to the ancestral spade.

(*g.*) The Scotch-plow, so called, was considered in Loudon's time the best invented for general use. There were two kinds particularly recommended, the wheel-plow, best for ordinary plowmen, as being more steady; and the swing plow, lighter in draft but requiring a more attentive and experienced plowman. Certain general principles were laid down for English plows, whatever might be the form used. The part entering, perforating and breaking up the ground received a long, narrow, tapering, sharpened form, which affords the least resistance in passing through the land, and the mold board, that hollowed and twisted form, which not only tends to lessen friction, but also greatly tends to perfect the turning over of the furrow slice. The beam and muzzle were to be so constructed that the moving power of the team should be attached in the most advantageous line of draft, especially if the team were double or treble. The true principles of plow making were said to be mathematically stated in several works, and very fully in the Quarterly Journal of Agriculture for February, 1829. Loudon says the line of draft should be at right angles to the horses' shoulders, that

the bar or land side should be made a perfect plane, and run parallel to the line of draft, and that where this deviates more than two inches from parallelism to the line of draft it throws the plow to the left, and causes the hinder part of the mold board to press hard against the furrow, crushing it and making the draft harder for the team. A colter standing more oblique than 45°, makes the plow choke up with stubble and grass roots, by throwing them up against the beam, and if less oblique, is apt to increase the draft by pushing the stones and obstacles before it. The mold-board may be more concave in light soils, nearer a plane surface in firm ones.

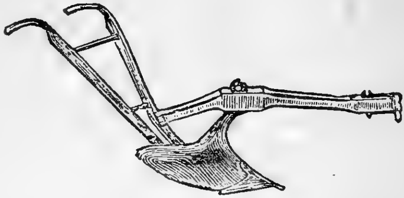
The best forms have the lower edge of the mold board in a separate piece, called the bearing piece, which when worn, can be replaced. The plow handles and beam are generally of wood the other parts of wrought or cast iron, or steel, as the case may be. In England the recent high price of timber, and cheapness of iron have led to its general substitution for wood in plow making. Iron beams and handles are becoming more common in America. The English plows are generally much longer than the American, and mostly provided with two wheels. An extended comparison of their respective merits will be found in U. S. P. O., 1856.

(*h*) Some of the American plows, about the year 1800, were very rude, hardly two alike; the wooden mold board was covered with old shoes, horse shoes and thin straps of iron, nailed on to prevent its wearing out. The landside was wood with the bottom covered with iron; the share of iron with hardened steel point; the beam a straight stick, and the handles cut from the branches of a tree. President Jefferson was one of the first improvers of the plow in America. He and Small discovered the importance of straight lines running from the sole to the top of the share and mold-board. He showed how plows could be made alike; the two wedges,

working vertically and laterally, so blended in a curve as that the furrow should rise and turn over smoothly and continuously. Chas. Newbold's plow, (cast iron), was patented in 1797; John Denver's in 1804; Col. Pickering discovered the importance of a straight line running from front to rear of the plow. Among the various patentees from 1807 to 1817 was Jethro Wood, who discovered that all the lines running from front to rear should be straight; said to be the first to cast the plow in sections, so as that the parts most worn could be replaced. After 1818, there was a great multiplication of inventors in this line. The Hingham self-holding plow (Massachusetts), was patented about 1823; also David Hitchcock's, which was highly recommended by J. Mears in the New England Farmer, (1830), for its pulverizing and other qualities. The wooden plows with wrought iron share and colter, were. said to be unlike in the mold-boards from the same maker; their constant swelling and shrinking loosened the joints so that the plow was weak and varying in its running, apt to clog and load up with earth, and paid too many visits to the blacksmith shop.

Many of the wrought iron plows worked well, but there was no certainty of their being alike; they were apt to work loose at the junction of share and mold-board, and about the bolts passing through their thin plates, and were inclined to crowd off, rather than raise and turn over the furrow slice. The wrought iron plow, with steel spring mold-board, was very similar to the last, but if well made, was thought to bear rough usage among rocks, stumps, &c., remarkably well. John Mears pointed out the practical means of obtaining a centre draft by the inclination of the land side inwards. In 1831, B. Thatcher of Massachusetts introduced a movable beam to the plow, adjustable vertically for regulating the depth of the furrow, and horizontally for giving it more or less width.

Figure four represents an old fashioned plow, from the shape of its mold-board, and want of a colter, less fitted for sod than stubble plowing; but its beam end, fitted low down in the handle, gives the plowman a stouter grasp on its movement, and the high curve of the beam where it joins the standard, saves it from clogging. It would be more easily managed than many recent plows in stony or stumpy ground.



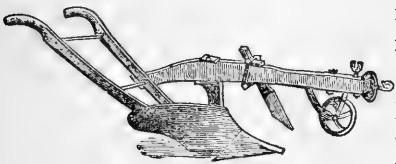
[FIG. 4.]

Mr. Knox showed how to lay down all the lines of the plow on a plane surface. Gov. Holbrook has been credited with a method of making convex or concave plows of any size symmetrical, so as to completely pulverize the soil. Aaron Smith made two plows work together, one throwing two or three inches of the surface into the bottom of the preceding furrow, and the other covering it with the lower earth. The Michigan double plow does this by means of two plows fixed under the beam, the smaller one most forward. Mr. Dunlap of Illinois, says no plow pulverizes soil so thoroughly as this. Gill's Columbus double plow, (1855), by its small one, first removes the roots of the grass, and by its large one pulverizes and throws over the under soil; harrowing being thus made unnecessary.

(*j.*) The side hill plow, (the English turnwrest, making the furrows on slopes horizontal, by turning them all down hill), was introduced many years ago in the United States. Mr. Bateham in Ohio Agricultural Report for 1849, describes it as operated by the plowman unhooking the hind end of the mold-board and letting it fall over on the ground, and then bringing it under and up on the opposite side, which is done easily and quickly. The mold-boards had been im-

proved and lengthened during the previous two years, so that level land was plowed with it nearly or quite as well as with the common plow; much time being saved by turning short about, and no dead or finishing furrows being left. Mr. Bateham adds, that on rich bottom lands and other mucky soils inclining to clay, the common cast iron plow was a failure; the soil adhering to the mold-board so as to prevent good work and making the draft hard; the best plows for these soils being of steel, or wrought iron case hardened and so highly polished as to keep bright. The Eagle and Centre draft plows were most approved in New York and New England; the different parts of the plow being so arranged as to place the centre of resistance exactly in the line of draft; the same result being sought in the use of the centre draft rod under the beam; those with the patent dial clevis and gage wheel were especially useful in sward plowing; of easier draft, running deeper and steadier, and turning a better furrow than ordinary plows.

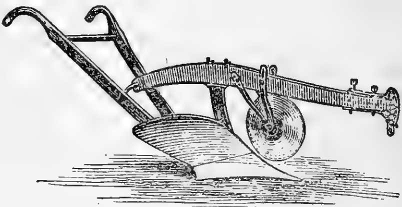
Figure five with its stout standard well set in the curve of the beam, its broad cutting knife and wheel to gage the furrows, and its mold-board receding in the rear, resembles the centre draft plow. The Pittsburg iron centre, (Hall & Spear's), took the first premium at the Ohio State Fair in 1852; the beam and handles of wrought iron; the mold board and land side of cast iron in one piece, the share and cutter also; it was made left handed as well as right handed. U. S. Agricultural Report for 1862 shows that steel plows were taking the place of iron ones; a saving of one day in every four was the supposed result. The importance of the law of virtual velocities (what is gained in power is lost in time or distance), and of the law



[FIG 5.]

of momentum, in connection with machinery, was adverted to. The Report for 1863 states that gang plows were heavy and liable to clog. A recent one (see Ohio Agricultural Report for 1871), is claimed to run two plows, a chain regulating the depth of the furrow; to save this from hard pan the lifting force is kept off the furrow by wheels and chain; a lever keeps the plows level at any depth of furrow; common plows in use can be attached to it; it has a seat for the driver, (boy, old man or cripple).

In 1863, the old standing colter was giving way to the wheel colter, cutting a smooth furrow. Cast steel plows were eminently fitted for prairie plowing.



[FIG. 6.]

Dunlap's weed-hook was described as a bent iron bar, two inches by three-eighths of an inch, so attached to the middle of plow beam, that the outer end runs in the open furrow, and draws in even the largest green weeds and corn-stalks, so that they are covered out of sight by the upturning furrow. The steel clipper plow, with highly polished steel mold-board and German steel share, was highly recommended for prairie work.

(*k.*) A New Yorker in the Report for 1866, mentions Hutchinson's improvement—the standard an extension of the landside—as preventing the clogging by large stubble; the Swivel plow, (Ames Plow Company, Boston and New York), the old side-hill plow improved; the cast cast-steel with circular colter, the entire mold-board, landside and share being of cast-steel: Kilmer's for plowing in green crops, aided by a chain attached to the whiffle tree and middle of beam, swinging against the mold-board; a smaller chain fastened to the handles holding it in position: the Cylinder plow,

its mold-board curve fitting a perfect cylinder*; Mead's conical plow, the concavity of its mold-board coinciding with the surface of a cone, with its large end to the front, securing an easy separation of the furrow slice; the Left hand plow turning the furrow to the left, preferred in some parts of Pennsylvania, and used to some extent in South-Eastern Ohio; and Gilbert's combined surface and subsoil plow, the subsoiler being attachable to any common plow. The Report for 1871 noticed an improvement on the rotary circular mold-board, mounted on a journal in its centre, so that as the sod passes over its face, the mold-board revolves on its bearing; the purpose being to lessen friction.

(*l.*) The subsoil plow does not turn over the soil, but stirs it, operating in a furrow made by the surface plow. It is intended to give the plant the benefit of a well tilled under soil, without exposing it, in its infancy, to the influence of barren or unwholesome substances. All subsoil plows, for easy movement, require a comparatively thin but strong standard, or its equivalent, with a wedge at the bottom. One pattern, for free soils, has the wedge thin, which when worn, can be replaced by a similar one in the rear. A stouter apparatus is required for stony or stiff clay subsoils. One kind has a rod under the beam, and two standards, with a broad flattish pointed wedge secured to them beneath; another three or four smaller standards; another a standard of cast iron plate, one inch thick, with a sort of flange or shelf on one side for pulverizing and raising hard subsoil, and a share-like wedge so strong that it cannot break. J. L. Gill's has a narrower standard, forked at top, at the fastenings to the beam, and a kind of vertical brace behind, with a stout and share-like wedge. Subsoilers that merely stir or displace the soil, have the lightest draft, some that raise it require two

*Joshua Gibbs of Canton, O., worked out a pattern according to a similar principle.

or three yoke of oxen. The Mapes subsoiler has been highly spoken of.

(*m.*) Patents for new plows or parts of plows are constantly on the increase, very many of which, for various reasons, whatever their merits, never go into extensive use. A rough count from abstracts taken from United States published documents, for less than three years from January 3d, 1872, shows of plow patents not otherwise classed, one hundred and fifty-four; wheel plows, thirty-four; gang plows, thirty; sulky plows, eleven; subsoil, eight; shovel and rotary plows, four each; steam plows, three; corn, ditching and cultivating plows, two each; side-hill, prairie, reversible, double, winged, riding, walking, double furrow and subsoil gang plows, one each; dynamometers, two; clevises, eight; whiffle trees, eight; shares and cutters, three each; wheels, beams, standards, cleaners, mold-boards and plow points, two each; plow carriage and runner, one each; stalk and stubble cutting attachment, one or more.

It is stated in a recent U. S. Agricultural Report, that the applications for improvements chiefly have respect to the mold-board, landside, standard, brace, colter and clevis; but more lately for fenders used to bend weeds and other trash away from the mold-board, to be turned over by the plow. In 1869, most of the improvements on wheel plows were from California and Oregon.

(*n.*) Sidehill plows have been recently patented, placing the right hand and left hand back to back, the beam and handles being swung around at the end of the furrow so as to make each alternately do duty. Another kind has one plow on top of and another under the beam, which are inverted at the end of each furrow.

An analysis of the first premiums for plows awarded at the Ohio State Fairs from 1852 to 1874 as detailed in the Reports of that State, shows that twenty-eight were awarded

to persons or firms representing Springfield, Ohio, of which nearly all were awarded since 1859; about as many to Cincinnati, awarded up to 1860; the awards now referred to being for specific plows, including plows for general purposes, sod, stubble, sidehill, sub-soil, one-horse, double, double-shovel, cast iron, steel and mole plows; and plows for black muck, clay and light sandy soils; to Cleveland and Columbus each less than half, and to Dayton, Canton and Maumee City Ohio, and Pittsburg, Pennsylvania, each less than one fourth of Springfield's number; and to the following cities or villages fewer awards down to one, viz: Delaware, Ohio, Richmond, (Indiana), Four Corners, (Huron County, Ohio,) Moline, (Illinois), Enon, (Clarke County, Ohio,) Hamilton, North Fairfield, (Huron County), Troy, Ohio, Peru, Indiana; and the following other places in Ohio, Sidney, Toledo, Bucyrus, Xenia, Yellow Springs, Lithopolis, Zanesville, Malta, Salem, Alliance, Akron, Alpha, (Greene County), Bryan, (Williams County), Monclova, (Lucas County), Willoughby, (Lake County), New Paris, (Preble County), and Monroeville; and Rochester in Pennsylvania, and Whiteford in Michigan, &c. Plows from various places also received second premiums or commendation.

The Report of the Committee on Plows at Ohio Fair, in 1872, required of plows competing at trials, a furrow thirteen inches wide, and seven deep; for sod plows, those were preferred which turned the sod without breaking, evenly and so far over as to hide all grass or other green stuff, and thus prevent its growth interfering with the tillage crop, and at the same time crushed the soil turned up and lying below the grass roots so as to make the best seed bed. Those were pronounced best for stubble, which most nearly covered all the litter, so that it would not interfere with tillage; a good seed bed being provided. Lightness of draft tested by the

dynamometer, good material and workmanship, durability, and fair prices were also considered in awarding the premiums. Among the plows described in Ohio Agricultural Reports, is that of J. Ball & Co., Canton, Ohio, 1870; the beam being the basis of all attachments; the wearing parts, mold-board, share and landside, have steel and cast metal duplicates, admitting of change from general purpose to stubble plows, and *vice versa*.

The Heiser sod plow, (1871), has a rotary cutter and a rear mold-board of a shape to save friction. The Aughe plow, (Dayton, 1871), for sod, &c., is said to be especially fitted for bottom land. Trials by the dynamometer in 1862, showed a Springfield plow cutting eight inches deep by thirteen wide, with colter, as drawing four hundred and thirty-eight and one-half pounds; a Cleveland double, eight by fifteen inches, seven hundred and seven and a half pounds; single plow without colter, eight by twelve and a half inches, four hundred and forty-four and three-fourths pounds; a Salem subsoiler, twelve by twelve inches, seven hundred and thirty-seven and three-fourths pounds.

(*o.*) At the opening of the Centennial Exposition, at Philadelphia in 1876, there was a good show of English plows, and one of the points observed was the long mold-board with the rear lower edge curved in, suggesting a diminished friction from the furrow slice after it is lifted up, and while it is being turned over. Mold-boards of somewhat similar construction have since been observed at farm houses in Southern Ohio, said to be very effective in stiff clay. Steel plows have been rapidly coming into use in this section; many farmers preferring the cast iron points, as being more easily replaced when worn.

The following were among those receiving awards on plows at the Centennial as stated in the Cincinnati Daily Gazette, near the close of September 1876: Moline Plow Company,

Deere & Co., Moline Illinois; Skinner & Bro., Des Moines, Iowa; South Bend Iron Works, Indiana, (chilled plows); Richmond Indiana Plow Works; P. P. Mast & Co., Springfield, Ohio, Buckeye Plow, &c.; A. Spear & Sons, Pittsburg, Pa, (hillside or turnwrest plow.)

(*p.*) Steam plows had made some progress in England in 1858, when Fowler's took the prize of £500 at Chester. Mr. French describes the plow as arranged in two gangs of three or more, one gang at each end of a heavy frame work balanced across an axle supported by two large wheels, and drawn with the plows across the field by a stationary engine. Two men sat on the machine, one to guide its motion, the other to make signals, &c. The plow was drawn *toward* the engine by a wire rope passing across the field, round a pulley made fast at the opposite headland. This pulley was held by an anchor—a four-wheeled car heavily loaded with stone; the sharp edged iron wheels cutting down nearly to the axle; the anchor being drawn along the headland by a windlass worked by a man in a direction at right angles with the furrow. It was of practical utility only on large, level, clear fields. The force working it, as seen by Mr. French, were five men and a boy; it plowed one acre an hour. Six English plowmen and twelve horses would, for six hours, do the same work as the five men and the boy, engine and machinery. The engine would need no rest, but would be liable to accident, and it would cost time and money to place the machinery in position.

Boydell's Traction Engine met with less favor. It drew six plows, opening six furrows across the field, drawn by a locomotive, laying down an endless railroad track for its wheels, and taking it up in its progress. It came to the field from a common road, drew its tender with coal and water, and carried the extra clothing and dinner of the laborers. It turned readily at the end of the furrow, and could, it was

claimed, do most of the farm work instead of horses. The driver sat on the fore-part, the engineer rode behind —Smith's steam cultivator did not turn over, but stirred and smashed up the soil; it was worked with a stationary engine.

At the Chicago Exhibition of the United States Agricultural Society in 1859, J. W. Fawkes of Pennsylvania took the gold medal offered for a machine to supersede the plow as then used, and most thoroughly disintegrate the soil with the greatest economy of labor, power, time and money. It was a locomotive running on a large drum, six feet in diameter, and six feet long, drawing a gang of eight plows, turning over three and a half acres per hour; the work said to be excellent. James Waters' steam plow competed with it, its machinery being more cumbrous and expensive. An extended description of other American steam plows appears in U. S. Agricultural Reports, 1867, 1869, 1870 and 1871. Plows and attachments patented by United States in 1869 were two hundred and fifty-five; in 1870, one hundred and eighty-two, and steam plows four; in 1871, plows and attachments one hundred and sixty, steam plows, thirteen. In 1867 it was stated in the Report of the Commissioner of Agriculture, that three thousand steam plows were at work in England with stationary engines capable of driving three to six plows, and doing better and deeper work than formerly, with a reduction of one-third of the horses and one-half of the laborers. An agricultural writer says that a team of four horses plowing a furrow ten inches wide, will leave two hundred thousand foot prints on an acre. This packing process might be obviated by steam. In England, including interest on investment, depreciation and repairs, the average yearly cost for maintaining a set of steam cutting machinery for breaking and cultivating two thousand acres, ten to twelve inches deep, is said to be not more than £300, or seventy five cents per acre.

But the conditions of American agriculture are so different

from those of England, that time alone can determine how far steam culture can be made generally practicable in the United States.

CHAPTER XV.

PLOWING FOR THE MAIZE CROP.

(*a.*) Farmers frequently consult their convenience in plowing. In the fall after the crops are harvested they are apt to have most leisure. During that season there are usually dry spells, when the plow on common soils will run very easily; stiff soils which plow badly when wet, plow very hard when very dry. Probably the fall more than any other season, finds clay soils in the right state for plowing; besides the freezing and thawing of winter effects their best pulverization. Winter plowing produces similar effects. An Illinoian in U. S. Agricultural Report, 1863, describes the result of winter breaking prairie ground with the double Michigan plow as excellent. He sets the upper plow (on the same beam), within two and a half inches of the lower one; it cuts the turf from one and a half to two inches thick, and it is rolled up like half of a stove pipe or scroll, over which the lower furrow is thrown, thus making air space under the turf, which kills the grass and aerates the inverted soil. The plowing can be done during open spells in the winter, or early in spring when the ground is saturated with water. Three horses will then break two acres per day. Mr. Dunlap says he never had the turf so well and quickly rotted as with this winter breaking, and that prairie can thus be broken at a time of comparative leisure with less teams and in all respects better than in July. Fall plowing finds many advocates in a very different region—Northern New England. Correspondents of U. S. P. O., 1853, from different parts of the United States,

are about equally divided as to the eligibility of fall and winter, or spring plowing. Fall plowing for sod has probably more advocates than for stubble, except where the latter is a stiff clay. One would suppose that the greater length of time the sod was turned under, the more complete would be the decomposition, and in many sections it doubtless is so; say where the long lying winter snows keep the soil in somewhat of an equal temperature; but if the process is disturbed by great changes of heat and cold, we may well believe, with some, that spring plowing is the most effective in thorough decomposition. Rapid decomposition, while it continues. is apt to make the soil more spongy. Many farmers make a great point of not disturbing the sod turned under, as being the chief store-house for feeding the roots in the maturer and later growth of the plant.

(*b.*) When stiff, heavy and adhesive soil, especially if clayey, is plowed wet in any considerable degree, it is apt to cake, and is injured by treading. Only sandy or light loamy soil will bear plowing when considerably wet, unless it is sod, which must not be plowed miry. Very dry, sandy land is in danger of drying up too fast for the growth of seeds, and is safest merely stirred to prevent the growth of weeds. A dry season is required for plowing marshy, moory or peaty ground already under tillage. Clay soils once well and thoroughly plowed, are made better absorbents of moisture by replowing in dry seasons, which is easily done.

(*c.*) Deep plowing is the rule, and shallow the exception. In some prairie lands, where the sod of centuries has become very dense, thin slices are said to decompose so much faster as to yield better crops the first year. If the soil and subsoil are rich, deep and similar, deep plowing is not so necessary as where the surface of such soil is considerably worn, in which case it greatly ameliorates the crop. But it is unsafe for a farmer used to plowing only six inches deep to double

the depth at once, unless he well knows the character of the undersoil, and that matters unwholesome to vegetation will not be brought to the surface. If the top soil is thin, and the subsoil hard and poor, it is safer to go very little deeper than the good soil, unless the plowed ground is thoroughly manured and harrowed. Many farmers have successfully tried going one inch deeper every year, till the required depth was attained. Wherever deep plowing is feasible, as in retentive soils, it largely increases the stores of moisture and plant food, and goes far towards nullifying the effects of drought. Deep plowing requires wide furrows. A writer in the Ohio Agricultural Report for 1863, maintains that deep plowing is most effective in autumn, not only pulverizing the soil for the passage of the roots into the subsoil, through the influence of frost, rain and air, but so acting on its mineral ingredients as to render them available to the succeeding crop; that it is most beneficial to stiff clays; and that as a rule we may plow deep when the subsoil is of the same character as the surface soil, provided both are tenacious; or when the subsoil is of good clay, only requiring atmospheric influences to sweeten it; that deep plowing should be avoided on nearly all very light soils, and in plowing for crops after a large application of manure, or in turning under clover or other green crops, if it buried them too deeply. He claims that deep plowing in autumn on most clays is equal to half a dressing of manure. Mr. Holbrook in the New England Farmer says that when land is of close texture, with a strong compact subsoil, it is not unusual to find a better underneath than that which has been worked so long and shallow on top. By breaking through this artificial hard pan and bringing up a portion of the undersoil to the light of day and the influence of manures, the crops will be considerably increased, even though only the customary quantity of manure per acre is applied. He would have greensward plowed in Novem-

ber nine or ten inches deep, according to the quality of the subsoil, and in spring a good coat of manure spread on it; if fine, to be mixed with the soil by the harrow and cultivator; if coarse, to be turned under, say four inches by light cross plowing without disturbing the sod underneath; green manure at that depth decomposing readily with more benefit to the succeeding corn crop than if turned under the sod.

(*d*.) The subsoil plow makes the undersoil penetrable by the roots of the growing maize, and gradually prepares it for acting the part of the true soil. Where the top soil of river bottoms has been worn down by long cropping, subsoiling enables the long roots to bring up fertile matters accumulated below. Going down sixteen to twenty inches below the surface, it provides for the surplus waters which might have washed away the surface soil, a retreat where they will not stagnate so as to hinder plant growth, but become a reservoir of moisture in times of drought A deeply mellowed soil and subsoil becomes a storehouse for the carbonic acid and ammonia absorbed from the atmosphere; it economizes dews and light showers, and diminishes radiation, being safer against frosts.

A writer in U. S. Agricultural Report 1862, says, that a soil already deep and loose does not need a subsoil plow. A gravelly bottom to the furrow would be little better after its passage. A sterile subsoil with a rich top soil would only serve as a regulator of moisture; a heavy and undrained soil would only be benefitted temporarily; the first heavy soaking it received would settle it back again to its original compactness. But for any hard subsoil, whether sterile or not, if naturally or artificially underdrained, the benefits of subsoiling would last some years without the process being repeated. When both surface and subsoil are naturally fertile, it is eminently advantageous, and the trench plow, (a substitute for the subsoil plow) may be used to its full depth without fear.

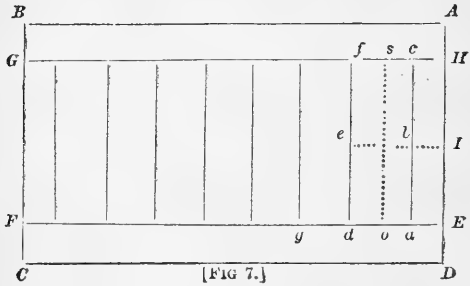
The subsoil plow or attachment, is run in the furrow left by the common plow. Writers differ somewhat as to the frequency of its use; the earlier recommendations being once in five or six years; it being often difficult to go down more than a few inches at first subsoiling; one or two inches might be added at the second, and so on till the greatest possible depth is obtained. Others advise more frequent subsoiling. The single subsoiler follows the common plow in the same furrow, if there are two teams working at the same time; if only one, the plowman first strikes the common furrow, then changes the team to the subsoiler, and stirs the bottom of the same furrow. The subsoil attachment provides for combining the two operations. The importance of underdraining in connection with subsoiling will be readily understood.

(*e*.) The width of the furrow depends partly on the depth, and partly on the nature or object of the plowing. A furrow six inches wide, and six inches deep, would not easily turn over, but would rest on edge. If nine inches wide and six inches deep, it would turn over either flat, as many of the English and Americans prefer it, or so as that the furrows will overlap, according to the Scotch theory and practice, followed in some parts of the United States. A wider furrow in proportion to depth, will be more apt to turn over flat. The best theoretical proportion as determined by English agriculturalists for overlapping or ridge furrows, standing at angle of 45°, is the width to depth, as three to two. In practice even for good ridge plowing it is not necessary to adhere strictly to that angle or this proportion. Some maintain that, if the object be to loosen the soil, a narrow furrow should be taken; if to turn over grass or turf, a wide one. But a wide working plow can be easily made to work narrow. The medium depth of good plowing has been reckoned at seven inches; say the average lies between five and nine. Of sixteen farmers in different sections of Southern Ohio

whose testimony as to the depth of breaking up ground was written out between 1872 and 1877, one working high table clay land plowed four inches deep, another on mixed loam plowed shallow; another on elevated and level land plowed ten inches if the team would bear it, but his neighbors generally from four to six inches; others on varied hill and run bottom, from five to six inches; others on hill land rather loamy, six to eight inches; one on clayey hill land, eight inches; two on bottom, river and creek, eight inches; one on old Muskingum bottom, six to nine inches; one on Ohio bottom and adjoining hill, red and yellow clay, eight to ten inches; one on sandy plain, second Ohio bottom, eight inches for sod, and ten for stubble; one on dark red clay hill land, deep as he could plow, and another deep on both hill and bottom.

(*f*) Most farmers inquired of in the section alluded to, turned the sod over flat, and the recorded statements of large numbers throughout the United States, are to the same effect. Ridge plowing on the other hand, has many advocates, and they are probably increasing. Southern English farmers claim that flat plowing smothers the weeds; and others that it better secures the decomposing sod from disturbance during after tillage. Flat plowing may answer well for light soils; and dry sandy soils should be kept as level as possible to prevent their scorching, washing and excessive draining. Many of the Flemish farmers used the binot, elevating and depressing the sod into small ridges, which leave more surface to air and frost. Ridge or lap plowing has a similar advantage in stiff, hard soils, especially if fall plowed. When the furrows lap, it is claimed by some that there is less chance for weeds, &c., to come up between the furrows. But probably their greatest advantage is in moist regions where they act as covered or open drains between the furrows, making, after fall plowing, early spring work more

practicable. Lap furrows will be more effectively harrowed and yield more mold. They are made by turning two furrows together on an unplowed surface, so that their edges will touch each other, leaving the land in alternate furrows and ridges. A more scientific method has long been practiced in Europe, the first operation of which is striking the furrows. The usual breadth of the ridges is from fifteen to eighteen feet. The plowman takes three or more poles shod with iron, eight or nine feet long, and divided into feet and half feet, and first lays off *headlands*, say eighteen feet wide, ridges parallel to the side of the field on which the horses are to turn, (fig. 7) *A B G H*, and *C D E F*, by running the furrows *E F* and *G H*. He then measures off *E a*, *I b*, and *H c*,



[FIG 7.]

seven and one-half feet each, and setting poles at *a*, *b* and *c* (if these are enough to guide him in running a straight furrow), he enters his plow at *a*, and then measures off fifteen feet to *d*, planting there the pole taken up at *a*. He then drives the plow to *b*, and measures off fifteen feet to *e*, planting a pole there; then finishes the first furrow in a straight line to *c*, and measures off fifteen feet to *f*, planting a pole there. He then turns short about and returns by the furrow *c b a*, throwing the earth in an opposite direction, correcting as he returns, any irregularities from unsteady motion of the

horses in the first track. The poles being now in the line *d e f*, he enters his plow at *d* and measures off fifteen feet to *g*, fixing a pole there; then plows to *f*, repeating the previous operation with the poles, and returns with a back furrow to *d*, and so on through the field forming open parallel furrows fifteen feet apart, the centres of future ridges.

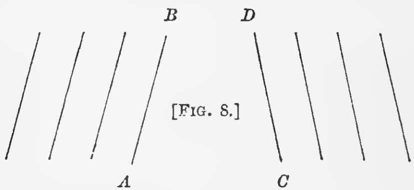
He then plows out the ridges: beginning at the left hand side of the open furrow, he throws his first furrow slice towards it; then returning on the opposite side performs the same operation, making the two first furrow slices rest on each other, and by always turning to the right, and laying his furrow slice towards the centre of the ridge till he has reached its boundary on one side *E H*, and the line *o s*, half way between *c a* and *d f*, on the other, he forms the first ridge *H E o s*, of which *c a* is the crown or centre; and in like manner the whole is formed into ridges, of which the first marked furrows are centres.

However, when the plow has moved from *a* to *c*, he may turn his horses left about and return from *f* to *d*, and so on, always laying his furrow slices towards *a c* and *f d* respectively; thus plowing the half of adjoining ridges and ending at *o s*, half way between them. This is said to be the most convenient method in practice. The headlands *A B G H*, and *C D E F*, are formed into ridges after the previous ones are finished. The ridges thus become slightly curved, and by plowing the earth away from the intervals, the ground is hollowed there, forming open furrows or drains for the surface water. The ridge may acquire a greater curvature and elevation by plowing the whole of it a second time in a similar manner.

Other changes may be made in the ridges, such as plowing two ridges together, called *casting*, or laying together the half of each adjoining ridge, called *cleaving*. In the original laying out of the ridges, their boundaries have been con-

sidered straight lines; but irregularities of surface and other causes often require a change of direction of the ridges in some parts of the field, to carry off the water. Where the direction is to be changed, the plowman runs a furrow straight or curved; the one set of ridges end here, and others are laid off from it in the new direction. The sloping of the fields, or situation of the ditches and fences, must generally regulate the direction of the ridges with reference to surface draining. If there are hollow places where water stagnates, suitable outlets must be opened by the plow or spade. The ridges are best North and South, for if East and West, the north side lies somewhat less to the sun than the south side.

(*g.*) Where ridge plowing is not needed, the plows may either follow each other round the entire field to the centre, or the field may be divided up; long parallellograms being most convenient when the shape of the field or surface will admit of them. Great accuracy in laying out the lands will add very much to the ease of plowing; if the same width is not preserved, but the plow cuts too wide here, and too narrow there, some of the surface will be left unturned, and some turned a second time. Where ridges are laid diagonally across steep slopes, to lighten the labor, and weaken the torrents wasting the surface, they should slope upwards, as in



[Fig. 8.]

figure eight, from *A* to the right hand to *B*; and not from *C* to the left to *D*; for in the former case, as the cattle ascend the steep, the furrow slice is thrown down-hill; whereas in the latter, as they ascend, their labor is greatly increased by

raising the furrow slice up hill. The advantage of the sidehill plow which works horizontally, always throwing the furrow down hill, is here apparent. Somewhat modified as the swivel plow, the team drawing it alternately gees and haws, turning short about at the end of the furrow, and plows level land very effectively.

(*h.*) A good plow is very important to successful plowing, sharp and bright, and of a shape to effect the special purpose intended; also a good strong team, so well trained that their guidance will not prevent the plowman from giving full attention to the movements of the plow; the plow horse should be broad in chest and on the back, and not be encumbered with unnecessary gearing. Very much depends on the plowman, who in England, is born and bred to his business, and turns a furrow with the greatest precision. To run straight, even furrows, but slightly differing in depth, is far more important to the crop than to get over a large quantity of ground in a day. The closer the horses are harnessed to the point of draft, the less exertion will be required to overcome the resistance. Plowing with a pair abreast, the strongest horse should work in the furrow; with the team harnessed in line, the tallest should be foremost, if fully equal to the others. It is stated in U. S. Agricultural Report, 1862, as the opinion of an experienced stage proprietor, that three horses abreast draw as well as four with two leaders in advance in the ordinary way; which agreed with the correspondent's experiments.

As the right hand horse walking in the furrow, necessarily places the other two so far to the left as to create a new centre of draft, a special contrivance is necessary to enable the common plow to run as with two horses. Some plow makers place an iron arc between the handles, to which the rear end of the beam is screwed, and along which arc it can be moved, till the right centre of draft is attained. "Another way is to construct a clevis bent several inches to the left

side of the beam. Three horses are driven by the plowman with the same facility as a two horse team, and do not require an additional driver, as becomes necessary with four." A correspondent of the Cincinnati Weekly Gazette, (1870), describes a treble tree as consisting, first of a double tree four feet long; the outside horses are attached to this in the usual mode; for the middle horse a single tree is attached to an equalizer, standing erect, attached to the plow clevis; the lower end of this is attached to the two horse double tree, five inches below the plow clevis; while the single tree of the middle horse is attached to the upper end ten inches above the clevis. The horses will then walk steadily as if only two were plowing together. An excellent way to plow deeply in breaking up sod ground.

The plow team is easily managed, and draws easier for being kept in as regular and brisk a pace as the work will allow. Breadth and depth of furrow being known, "the plow should be held upright, bearing equally all along on a straight-sole, and be made to move forward in a regular line without swerving to either side, and the edge of the colter should be set directly forward, that the landside of it may be in a parallel line with the landside of the head. The plowman should walk with his body as nearly as possible upright, without leaning on the stilts, and without using force to any part, other than may be absolutely necessary to keep the implement steadily in a straight line. He should also be sparing of his voice and of correction to the team; of the former, because much cheering and ordering only confuse the cattle, and of the latter, because punishment often repeated, ceases to have due effect, and thus leads to unnecessary beating."

(*i.*) Where the plow has not the special adjustments for regulating the pitch, it may be made to go deeper by lowering the back bands, or increasing the distance of the team, by setting the muzzle higher up in the index of the beam,

and by giving the colter a greater rake forward; and the reverse will make it go shallower. Hooking the traces into notches of the muzzle more towards the unplowed ground, you narrow the furrow, and widen it by shifting them to the other side, or pressing the handles towards the right. Some plows have adjustments for taking more or less land.

(*j*.) The line of draft, when the horses are properly hitched, follows the traces from the point of draft at the shoulder, through the notch at the end of the plow beam, to the point of the share. The shoulder is nearer the ground in the act of pulling, and allowance must be made for this in selecting the notch suited to the animal's height. The higher the beam above the bottom of the furrow to be plowed, the longer and the more need for lengthening the traces. Priest's experiments with a furrow nine and a half inches wide, and three and three-quarter inches deep, when the traces were ten feet five inches from the point of draft on the horses' shoulders, to the point of the share, made the power of draft only two and one-fourth hundred weight; with the traces lengthened to fifteen feet six inches, the draft force was three and a half hundred weight.

In corn tillage, deep and thorough plowing, so as to put the soil in the best condition for a seed bed, is at least half the battle. This is most easily accomplished where the land has been underdrained. As Mr. Klippart in Ohio Agricultural Report, (1858), remarks, "corn delights in a loose, dry, warm soil."

CHAPTER XVI.

HARROWING, ROLLING AND PLANTING.

(*a*) The earliest harrow is thought to have been a common hawthorn or other stiff, spinous, woody plant, so pruned as to lie flatly on the ground, and make numerous deep, parallel scratches; the like is still used in some cultivated parts of Asia. Another early form was a wooden frame of bars and cross bars with projecting wooden teeth. Most modern harrows have the teeth of iron, and some of them the frame also. To adapt them to special soils, and special conditions of soil, the materials, weight, size and mode of traction have been greatly varied. The rectangular form is still used more or less; one recently patented having the cross bars set with teeth in such a manner as when drawn straight forward, to make a series of equidistant and parallel scratches. But the rhomboidal form, to some extent, and the triangular to a great extent, have taken its place; and the changes in the forms of the frame and teeth are intended to make the harrow act more uniformly and steadily in tearing up the broken surface, leveling as it pulverizes. For grounds free from obstructions, the teeth should be small and numerous, say about fifty teeth, three-fourths inch square; where the soil abounds in roots and stones, the teeth must be fewer and larger, say thirty to a harrow. The teeth will do better work if the edges, instead of the flat side, are to the front. Sometimes the teeth are rhombic; and for very hard soils, flat, sharp edged steel teeth are used. The harrow is very effective in distributing manures. On plowed sod, it is usually run in the direction of the furrows; on stubble often both ways in turn. Fall plowed ground is frequently harrowed in

the spring, previous to planting or replowing. If lumpy, a light shower makes it crumble down easier. When the front tooth is taken out, it very thoroughly weeds and smooths the corn rows just peeping out of the ground. The objections to this harrow is that it gets clogged with stubble or other obstructions at the surface; and on uneven ground, its scratches are irregular and incomplete. These are remedied in the double A harrows, one triangle fitted partly inside of another, either by a single hinge, or by two hinges connecting two contiguous central beams running back from the front angle, so that the whole harrow folds up like the leaves of a book, and so that one part may be lifted to clear away obstructions, while the other does its work. Sometimes the two are bound together by flexible metallic springs.

Shear's harrow has sharp flat blades, sloping backwards like a sled runner, and as they pass over the inverted green sward, they press down the sod, while they make powder of its upper face. A single passing is said to mellow the surface more than twice as deep as the common harrow; meanwhile rolling the grassy part down in its place. Steel teeth are far better than iron ones. A tooth has been patented with the front side steel, and the rear iron. Nishwitz's harrow has rotating teeth, which are described as circular disks, about one foot in diameter, concave on one side and convex on the other, and are said to make mince meat of the soil. Another harrow is the steel tooth expanding and self adjusting, cutting the sod both vertically and horizontally, and is claimed to cross harrow sod without inverting the furrows, and to expand and contract to suit the wants of the farmer. One construction, for disintegration of soil, makes the underside of a harrow frame solid, and is provided with a series of ribs like those on a washboard. Double rectangular, rhomboidal, circular, rotary and revolving harrows of various forms, and harrows with frames of metallic pipe, have recently been pat-

ented. In harrowing large fields there is often an advantage in yoking several harrows together; three yoked together drawn by three horses, are said to do as much with one driver, as four harrows, with four separate yokes, each having a driver.

(*b*) Rollers are a more recent implement, of great use in certain cases for clod crushing, and in common use in many maize growing districts, on plowed ground just after planting, and on the rows just coming up. They were first made of a single log, two or three feet in diameter, shaped to something near a perfect cylinder, and fitted to a frame to which a team could be harnessed. This was greatly improved by sawing the log in sections, say one foot long, accurately dressing them, boring through the centres say one and one-half inches, and stringing the block wheels on a round iron bar. The timber ought to season one year under shelter with the bark on, so that it will not crack; white elm, or sycamore, is said to be good material. Each wheel, as the roller is drawn, turns independently. One writer says the best one he ever had was made with his own hands, of plank for the rolling surface, in two sections, four feet in diameter and eight feet long; it drew with great ease and crushed more lumps than a smaller one. Iron rollers are often used for heavy work; sometimes armed with points, sharp or otherwise, to make the clod crushing more complete. Some of them have been complained of, as torturing the team from the manner in which it was attached to them. The draft, it is said, should be from the centre of motion, instead of the top.

A writer in U. S. Agricultural Report, (——), recommends as the best now made, that cast in sections one foot wide and twenty-two inches in diameter, weighing one thousand pounds: it being of great value to prairie soils, and at corn planting, finely comminuting the surface.

Rollers are chiefly useful on heavy soils disposed to be

cloddy. Land may be too dry for the thorough pulverization of the lumps, and then a shower is a good preparation, if it does not leave the surface too wet. A moderate wetting makes the clods crumble down easily.

(*c.*) Furrowing out the prepared soil is the next process, according to the old system of maize culture. For this a small turning plow was most commonly used; one object being to throw out sufficient mellow soil to cover the dropped corn. For drills, the distance apart of the rows for the shorter growths, where the land was well cleared, and there were few obstructions to after culture, and the soil was rich, was three feet; in rare cases, say for sweet corn, a little less. For taller growing corn, three and a half to four feet, and in the South often five or six feet. Many experienced maize growers insist on an adequate distance between the rows, (three and a half to four feet.) for the better admission of the sun. For this a direction North and South would be preferable. This distance is probably better for new beginners in maize culture, who wish to raise well developed corn rather than fodder. Cross furrowing for hills has been very common; though many farmers use markers, running two or three cross rows at once. Where the same distance is not observed both ways, three by three and a half, three by four, and three and a half by four, are most agreeable to eastern and western methods; some furrow three and a half wide on their bottoms, and four feet on hills; and some four feet North and South, and three feet nine inches East and West. Machine planters, driven by horse power, furrow as they plant. The depth of furrows usually bears a certain proportion to the depth of plowing; say three to eight, or four to ten. Some furrow deeper on rolling than on flat land.

(*d.*) As to the varieties of seed corn suited for planting, see chapter VI herein. The following method of saving it is described in Ohio Agricultural Report, 1858, as an Indiana

farmer's: the seed is gathered early in September, when about half the ears of the field to be gathered from, have their husks whitened with ripeness, showing ears that have matured. Be sure to have the seed corn perfectly dry before freezing weather comes upon it. Enough husk is left on each ear to tie two and two together, and hang on poles in a dry, airy place, two ears deep to each pole. The ears ripening first should always be selected for seed. A farmer near Dodson, Ohio, goes through the field in the fall, and takes the ripest from stalks bearing two ears, and from those ears best developed, selects ears perfectly filled to the point. Only choice grains should be used; many use only those from the top end of the ear; others, those only from the middle.

(*e.*) As to manuring in the hill, see chapter XIII. Farmers differ in regard to soaking the seed corn. A Licking Co., Ohio, farmer, in 1849, found that soaking in copperas water, tarring and rolling in plaster, prevented the ravages of the ground mole, cut-worm, and various beasts and birds, but not those of the grub-worm. A Massachusetts farmer in 1853, found worms prevented by soaking in the above, or a solution of saltpetre. A Pennsylvanian in the same year denounced tarring, and protected a whole crop against the birds by sowing corn broad cast on the field at planting time. An Ohioan used the latter remedy in 1874. Ohio Agricultural Report for 1858 recommends mineral soaks, tarring and plastering the seed to disgust worms and grubs, but not as hastening growth more than water soaking. Several Southern Ohioans in moist weather, or in replanting, found soaking in water, nearly scalding, hastened growth. Another for replanting, soaked in water ten hours, and laid out to dry ten hours till sprouted, and then planted. A Kentuckian in 1877 soaked in warm water, and rolled in tar and land plaster. Others have mixed the seed with coal tar, and rolled in quicklime till the grains became separated; others still have

used soot as a coating. A large proportion of farmers have preferred not to soak.

(*f.*) Into the question of the best time of planting corn in any locality—a question which every farmer as far as practicable, should himself determine by experiment—there enter the following elements among others: average temperature, average rain fall, exposure to sun, exposure to, or shelter from cold winds, wetness or dryness of soil, degree of fertility as regards the maize crop, general condition of the ground for tillage, and convenience in arranging farm work. A new hand at maize culture, or an old one in a new situation, must rely more or less on the established customs of the district, if it has any, or on general principles. The climatic relations of maize culture have been hereinbefore discussed. Where the planting season is too uncertain to work according to any general rule, there should be two times of planting, early and late, with varieties of seed corn to suit. Even where the seasons are usually regular, there are occasional variations, and it is best to be prepared for them. Where there is a tendency to dryness of soil, early planting seems most advisable; wet soils may be safer planted late. Very rich light soils bring on the crops so rapidly, that early or late, if they are well tilled, they are safest against drought and frost, but not always against flooding before or after harvesting. The safest general rule seems to be to plant as soon as the ground is in good order for tillage, sufficiently warm, and the weather is settled.

A correspondent of U. S. P. O., 1848, stated that there was at least two months difference between the planting times of Florida and Texas, and those of Maine, Wisconsin and Iowa; February and March being those of the former, and May that of the three latter States. This general statement shows that the farmers of the North are driven to a narrower choice of times for corn planting, than those of the South. An analy-

sis of more than eighty statements of U. S. Agricultural correspondents, representing latitudes between 47° and 31¾° North, shows more uniformity North of latitude 38°; only about twelve of the number being south of that degree. Of the former about fifty were in May, five in April, and seven or eight in June. A Wisconsin correspondent stated that as far North as Sandy Lake, Beech Lake and Red River, planting (early) was done about June 1st. In Arostook County, Maine, one of the most northerly Counties, corn was planted in June. In latitude 46°, (Maine), one plants 20th of May. In Jefferson County, New York, from 10th to 15th of May. More than a degree further South, in Wayne County, Michigan, near the lakes, early in May. The times for early planting gradually approach the last of April as we go southward to latitude 39°.

In the above list there were about thirty-five preferences for the first ten days of May, and twenty-nine preferences for the remaining twenty-one days of May. There were nine statements in which June, and nine in which April was mentioned. The following are among the broader statements: April; 20th of April to 20th of May; mid April to May; 24th of April to 1st of June; last of April to first of June; mid May to 5th of June. The plurality in favor of the first ten days of May is in accordance with a statement made many years ago by one of the most successful farmers in latitude 39°25′. Of the twelve statements south of 39°, we have Madison County, Illinois, near first of May; Buckingham County, Virginia, April; Cabarras County, North Carolina, 1st to 12th of April; Jackson County, Alabama, March till May; Milledgeville, Georgia, February; Barbour County, Alabama, March; in Washington County, Mississippi, corn would most probably ripen if planted in July; at Ft. Fillmore, New Mexico, planting was done early in April. On the whole, May seems the preferred month for maize planting

in the great corn growing States. A well known Journal, however, said in 1865, in substance: do not fear to plant corn till tenth of June. Better plant after this with ground in good order, than to have planted at any time previous with ground in bad order. If an earlier variety of seed can be procured, plant, to be sure of ripening; old Dent will probably ripen if planted before the tenth of June.

(*g.*) *Hand and Machine Planting.* The ground being furrowed, and perhaps manured in the hill, it has been usual to drop the corn by hand, and cover with hoes. A first rate dropper will so distribute the grains as to make the firmest built hill of corn. *Hand Corn Planters* make the hole, or place of deposit for the seed, and drop the right number of grains. See note on page 410. They are coming into extensive use, but are charged with dropping the grains too close together. When it is necessary to replant, they would seem to be, as compared even with steam drawn planters, both labor and seed savers. Quite a number have been patented; one of them being described as having a boot piece, a seed reservoir pivoted at its heel, valves, and a spring. Patents for wheel planters are much more numerous. Some plant two rows at once, and rows can be made with them at any distance apart, and the number of kernels regulated. Some of them are said to plant, in favorable situations, with great rapidity and exactness.

(*h.*) As many grains are imperfect, and the seed planted is liable to be destroyed by insects or otherwise, it is safe to plant six or eight in a hill, and pull up all but three or four. If the soil is not in the best condition, only two or three should be left to attain full growth, unless the hills are very wide apart. If the plants cannot obtain their nourishment below, they must spread out. The quantity of seed planted on an acre for general crop, has been averaged at one or two gallons; some drill one half bushel to the acre. Many

farmers prefer to plant just the number they wish to remain in the hill, being very careful to have the selected grains perfect. Where the hills are three or four feet apart, it is common in the Middle and Western States to drop three kernels in a hill for permanent plants. Where the corn grows very tall, as in the Southern States, it was formerly the practice to make the hills from four to six feet each way, and drop, or leave permanently, two grains in a hill. When the soil is naturally very rich, or is made so, being rich and mellow, well developed grains may be planted thicker, as will be seen in the statements connected with large crops. If the planting is in drills, say four and a half by two feet; four and a half by one and a half feet; or four feet by one as the custom is in different southern or western localities, or three and a half feet by nine or ten inches as more common further North; only one plant is usually left in the hill. Mr. Ludlow of New York, (see New England Farmer, 1829,) raised ninety-eight bushels of corn on an acre, in single rows, eight inches apart in each row. The better opinion is that more corn can be grown to an acre by drilling, though at a greater cost of time and implements. Some maintain that the riches of the soil can be more fully economized by having the plants stand singly. Where they are somewhat spread in the hill at planting, it is not unlikely that they help to brace one another.

(*i*) As to the depth of planting or covering, something has already been said under the head of "Large Crops." In cases where successful planting has been very deep, say four to six inches, either the climate was warmer and the planting very early, and the ground put in the best condition for growth by the retention of sufficient heat and moisture; or, if the soil was cold, the seed was enclosed in some material such as sifted coal ashes, to keep it warm and thrifty. Experiments on a small scale were made with the latter in 1877

on corn grain planted from three to four inches deep, some on 28th of March, some on 7th of April; eight or ten grains of small roasting ear corn being thus put in a hill. A few hills came up entire, others in part; scarcely any of the hills wholly failed, and more or less corn was ripe for boiling by the second of August.

This, however, would be an expensive way of planting on a large scale, and the general rule favors a depth of one and a half or two inches. The fine soil wants to be pressed round the planted grains, either by the hoe at the time of covering, or by the roller after the field has been planted. One object is to bring the earth closer to the germinating grain, and another to prevent radiation, and keep it from drying up; the first reliance of the germ being on the grain and not on extraneous matter.

CHAPTER XVII.

AFTERCULTURE OF MAIZE.

(*a.*) Scattered throughout the United States are large numbers of small corn fields in villages and large towns and in their suburbs, from one-fourth acre upward, which receive more or less culture with other implements than the spade, hoe or rake. It is very common for some one in the neighborhood who owns or drives a team and a plow, to do up by small jobs, the larger cultivation in these small fields. A one horse plow on light sandy soils suitable for gardens, frequently does both the breaking up and after cultivation. The double shovel is better for clayey and other stiff land; the old-fashioned shovel plow is sometimes used, throwing the earth both ways, stirring instead of fairly turning over the soil.

For very mellow deep garden soils, the garden cultivator was commended in Ohio Agricultural Report, 1869; being provided with wheels and pushed forward by the handles, and having several attachments, including a knife projecting from the beam into the ground at the bottom and center of the wheel, so as to cut the runners of strawberry and other vines when the wheel presses on them; a drill with pipe and wings for opening the ground, dropping and covering the seed, which can be removed when not needed; a share set angling with a wing to cover seed when desired, and throw dirt to and from the row; a common cultivator tooth, sharp at both ends, reversible, and wings attached to it; a scuffle hoe with sharp sides for cutting weeds at or below the surface; and a rake to level and weed the ground; these to be substituted for the share when needed, and fastened with a wedge. The first cultivation with the turning plow is with the landside or bar next the corn on each side, very close to it; if the rows are straight, throwing the earth away from it. This, when the corn is just up, and needs a good deal of sun, admits it more freely; and it cuts up the weeds next the young plant, and loosens the contiguous surface.

If the furrowing runs both ways, the second cultivation with the plow can be put off, say a week after running the plow in one direction; and in another week the soil thrown away from the corn can be thrown back again with the mould-board to the corn; and in the fourth week the same in the cross rows. By this time, if the season is favorable and the soil is in the best condition, the corn will have attained a height that will shade the ground; and if the weeds have been perfectly subdued, little more cultivation will be required. Where clay is predominant in the soil, it is very important to plow deep at the start, and continue to do so at short intervals, so that when drought comes, the roots will find abundant moisture in the spongy soil; if this is neglected

at nrst, deep plowing may be hazardous in drought. The roots make the best of their situation in the tough clay, and when the rough plow tears them and breaks up their nests, they often die out, and the crop is sometimes ruined. But where from the first, the roots become accustomed to that kind of frequent disturbance, which opens new paths for them, and fresh sources of plant food, they recover very quickly from their wounds, and gain instead of losing vigor.

(*b*.) The double shovel plow is better than the common one for stiff soils not plowed sufficiently deep; two small shovels will, of course, pulverize the surface better than a single shovel or turn plow. It is generally passed twice in a row, and for repetition the same rule might be observed as for the cultivating plow. This implement will plow nearly four acres a day. Where a seven toothed cultivator can be afforded, it is very useful in the latter stages of cultivation, as it shaves the surface without interfering with the roots and keeps it very mellow. Cultivation can then be continued till the corn begins to set.

A great variety of cultivators have been patented; most of them improvements on the old horse hoe, so highly prized on English acres. The two-horse cultivator on large clear fields, has come into extensive use; there are two small plow shares on each side, and the inner ones which come next the corn are somewhat in the shape of bull tongues. The arch connecting the right and left parts is high enough not to injure the tops of corn during the season of culture. On favorably situated land about nine acres a day can be tilled with it.

(*c*.) One of the best methods is to commence, when the corn is very small, with the bull tongue plow, which usually has a curved iron beam and iron handles, running very close to the rows, and as deep as possible, three or four times in each row; thus making a complete bed for the reception and

retention of moisture and fertilizing matters. Afterwards the cultivator or other shallow working implement may be used to keep the surface clean and mellow.

(*d.*) One reason why so many cultivating implements are yearly patented in the United States, is the fact that farmers frequently make their own. Differences of soil and specialties of surface are constantly suggesting new contrivances for obviating difficulties in practical maize culture. It is fortunate for the farmer that in so many cases he can make his own implements; if, as a consequence, he touches less of gold and railroad stocks, he has the real kingship, independence; this, however, may be carried too far. There is a reasonable dependence, as well as independence, and if he gives others besides the blacksmith and wagon maker the opportunity of working for him, he will find more buyers and obtain better prices for his grain and pork.

Some old fashioned implements have become a sort of necessity to the farmer; so the little corn harrow now and then turns up; the shovel plow is often a go between among later inventions; and the hoe will keep its place sometime longer. The old plows and cultivators left the hoe to finish up the weeds; the recent close cutting knives, spades and shares chop fine the weeds and stubble as well as earth, and fender attachments keep the loose soil off the tender plants ***a.** Some farmers remove the suckers as fast as they appear, others consider them fruitful and let them remain.

NOTE *a.*—Brief statements, with partial drawings, in the Official Gazette of the Patent Office of the United States, show the claims of the patentees; the specifications, including full illustrative drawings, and describing the subject matter of the patent in detail, as well as its object and *modus operandi* are embodied in large monthly volumes, containing full indexes of the names of patentees and classes of patents. Each of the monthly volumes of 1877, from January to June contains over one thousand pages of specifications, besides several hundred pages of drawings. There are also nine or ten volumes of General Indexes, for looking up patent matter from 1790 to 1876. They are found in the Public Library of Cincinnati, and probably in the other large public libraries of the United States. Inventors, manufacturers, and others interested in the sale or use of the subjects of patents, visiting cities having such libraries, might find themselves amply repaid for a few days careful study in these vol-

(*e*.) The number of times corn should be cultivated is less for the greater thoroughness of the first plowing, and the greater skill in planting; less for the greater sponginess of the soil; less for a wet season, and in some cases less for early neglect and for the limited number of suitable cultivating implements. In general it pays well for more frequent stirrings, if done skillfully in time. To determine the proper number often requires close observation and ripe judgment. For the following statements either the pens or lips of farmers are responsible:

Beginning back in 1850, or thereabouts, an Illinois farmer, when corn was up, passed a heavy harrow over the rows, then plowed three or four times between them. A Missou-

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umes; but it is difficult, from so large a mass of details, to generalize as to any special class of implements in extensive use. Something of the kind is done in U. S. A. R. 1869 and 1870, from which the following brief abstract is taken:

"Thirty years ago a man with a hand hoe could, by the aid of a horse and plow, for plowing furrows between the rows of corn, cultivate an acre in a day. Now, (1870), with a span of horses and one of our best riding cultivators, fifteen acres can be accomplished, and this with almost as much ease and comfort as a day's journey in a buggy." Nearly four hundred patents have been issued as to cultivators from 1872 to June 1877.

It is stated in U. S. A. R. 1869, that more than one hundred corn hand planters had been patented before that year. Hughes' patent had two legs pivoted together like the divisions of a candle snuffer, the lower end to be thrust into the ground to form an opening for the seed: the upper end having two handles. To the outside of one leg was securely fixed a seed box, into which extended a seed slide connected with the other leg. The lower end of the planter was thrust into the ground; the handles then brought together, enlarging the opening into the soil, and at the same time drawing out the seed slide with its charge of grain, which was dropped into the opening; the planter was then withdrawn and the seed covered and pressed down with the foot of the operator.

In 1828 Starr's patent for planting grain had handles and a beam similar to a common plow, supported from the rear by wheels; beneath and about the centre of the beam there was a shovel plow to open the furrow for the reception of the seed, and to the rear of the machine was attached an iron scraper to close the furrow after the seed was dropped. On the top of the beam was placed a hopper, in which a sheet iron cylinder was made to revolve by suitable mechanism; its edge perforated at suitable distances to receive pieces of metal, which acted as valves working upon a pin, and forced out by springs contained within the wheel, so as to project beyond its periphery, but capable of being forced in, when passing the ends of the slot in the bottom of the hopper. These valves contained the quantity of seed to be dropped in each hill, and might be more or less numerous, according to the distance at which they were to be dropped in the furrow.

Corn planters usually plant the seed in hills. A machine can easily be so arranged as to be changed from a grain drill to plant in hills, by diminishing the number of cavities on the dropping wheel. Then by removing the dropping mechanism the machine may be used as a wheel cultivator, a wheel plow, or a harrow; or even a land roller may be attached. Some corn planters have a reciprocating slide, similar to that described in seed drills and used in connection with a cut-off or brush for sweeping back the grain, and connected with a hinged valve in the runner, which receives the charge of grain after it falls through the slide, and by which it is dropped into the earth. The cut-off chiefly employed is

rian plowed three or four times with shovel or Carey plow. One farther South plowed three times, decreasing in depth. A Mississippian used first the narrow shovel, bull tongue or scooter plow; then thinned out; after rain used the shovel plow from and toward the corn, and killed weeds and grass with an iron toothed harrow, &c. Further North, testimonies multiply; the after culture being three or four times with the plow, at intervals varying from a week to ten days; the first from the corn in the main furrows; the second from the corn in cross furrows; the third to the corn in the main furrows; the fourth to the corn in cross furrows. A uses the

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a brush; though an India rubber sweep is sometimes used. Generally one or two scrapers to throw the loose earth upon the dropped grain, are placed in the rear of the runners.

The hand corn husker is described in U. S. A. R., 1869, as a small and simple instrument, designed to be grasped with one hand and to assist in tearing the husk from the ear–sometimes a glove with teeth or hooks; sometimes a device to be used like a pair of tongs, having two pivoted arms between which the husk is caught; often a little metal bar, with loops or rings for the fingers and a projection between which and the thumb the husk is caught. Their main object is to save the fingers.

Machine huskers are described as generally having a pair of corrugated horizontal rollers, with yielding bearings. The rollers bite off the ear from the stalk, which is presented to and drawn between them, the ear falling upon or being carried to the stripping rollers. The stripping rollers are generally arranged transversely to the horizontal rollers, and in a slanting position, so that the ear, when stripped of its husk and silk, may slide down into any suitable receptacle. These rollers are placed close to one another, and nip or catch hold of the husk and tear it from the ear in a very rapid and satisfactory manner. The stripping rollers are generally covered with some elastic substance as India rubber, and have spiral grooves or corrugations. In some cases, hard rollers are employed, and they may be grooved or corrugated, or one of them may be provided with teeth, moving through annular grooves on the other rollers.

In U. S. A. R. 1869, it is stated that the improvements on corn shellers patented in that year were chiefly variations on Houseman's patent, a hand implement. In its improved state it was composed of two iron bars about six inches long, pivoted together; the shelling ends or palms, which were semi-circular in form, being kept in close contact by means of a suitable spring; the palms were made semi-circular in form, so as to embrace the ear; and their inner sides bore ridges or ribs terminating in claws, which served to remove the kernels; the ribs having a spiral inclination which served to draw the ear through, when the implement was operated. In operating it the sheller was seized by a handle provided for that purpose, and the small end of the cob inserted between the palms; the instrument was then revolved, and the ear drawn through; the kernels being easily and quickly removed by the claws.

In this connection may be introduced a brief statement from U. S. A. R. (Agricultural Patents), as to grain bins intended for use in great grain markets as Chicago. These bins are frequently constructed of some porous material, generally brick, intended to absorb any superfluous moisture, and thus prevent grain from spoiling. The bins are generally made of circular form and are arranged in series side by side, in a manner intended to economize space as much as possible. In grain dryers, the inventors seem to have mostly in view the drying of the grain by the introduction of currents of air. These currents are generally introduced through perforated pipes, which run through the bins. Sometimes perforated partitions or walls are employed for a similar purpose.

cultivator with the plow to keep down the weeds, and put the ground in better condition; say two or three times, laying by with the cultivator at knee high. B begins soon as rows are seen, with the cultivator; then plows and hoes; corn fifteen inches high, uses both cultivator and plow both ways, and finishes hoeing about the time the spindle top appears. C, corn fairly above ground, thins to three or four stalks, passes cultivator twice each way, and repeats this at regular intervals, pulling suckers, till the ear begins to shoot. D, when the corn is three or four inches high, passes the cultivator two or three times between rows both ways till near wheat harvest. E runs it six times each way till near the time of tasseling. F, when the plants are quite small, uses the cultivator instead of plow; thinning, when ten inches high, the plants to three or four; supplies deficiencies by replanting, and stirs every three weeks or oftener, if weather dry, with plow and cultivator till ear sets. G works with cultivator till ten inches high, then with double mold-board and span of horses throws up a light furrow on each side. H keeps the ground loose and free from weeds with cultivator or double shovel plow, —stating that a triple shovel plow is fast coming into use. I, (a Virginian,) drags the horse rake with front tooth taken out, over the young corn, which should be immediately dressed with the hand rake with large spike nails for teeth; after dressing with the hoe (in stiff land), he runs the plow first from and then to the corn, being careful to uncover, &c. J plows from and to the corn and then runs the cultivator till the ears begin to set. K plows four times, breaking all the rows each time. L, when the corn is five or six inches high, has the best plowman running a furrow as near as possible to the plant, with the bar side next it. and another breaking up the intermediate space; both working deeply. M, with the subsoil or bull-tongue plow, drawn by two horses, one on each side of row, passes close to the young

hills, then with cultivator to clear out the middles; in ten days, with wing plow one way in a row throwing dirt to the corn; in a few days finishing with the cultivator.

The old fashioned hilling has long ago, as appears from the records, given way to level culture. Small hills are sometimes made. The hoe was formerly in use largely between plowings, except when these kept the ground mellow and free from weeds; it is dispensed with in much of the later culture. One farmer found that by plowing late, and planting from 20th to 25th of May, corn grew rapidly, and did as well without hoeing as the hoed crop did, planted in April. Rapid working is the rule. With reference to deep plowing in dry weather, an Ohioan remarks that if clay soil is first plowed only three inches deep, it could not be plowed again in a dry season, when the stalk is four feet high, because the soil would be so hard that the roots could not possibly penetrate the unbroken ground downward; whereas in clay ground, plowed ten or twelve inches deep, the roots go down in search of moisture, and if the soil is loose to that depth, descend even three or four feet. If only one side of a row is plowed at a time during drought, the roots on the other side can feed the stalk while the plowed side recovers itself.

Many farmers do not plow at all in time of drought, others merely stir the surface; others who begin early with deep plowing and keep it up at short intervals, plow in clay soils in very dry weather, all the deeper. But such corn ground plowed shallow, or seldom, or irregularly, before drought, is sometimes plowed deeply to the ruin of the crop when drought comes. Judge Buel passed the harrow at first dressing between the rows both ways; used the hoe little more than to destroy weeds; at second and last dressing plowed shallow, and earthed the hill slightly, not disturbing the roots or bringing manure to the surface. Many farmers inquired of, during recent years, prefer the double shovel plow, used from

three to five times The two horse cultivator, with the bull tongues inside so as to run deep and close to the corn, has already been referred to, and is much used on large clear fields for early culture.

(*f*) The proper time for cessation of culture is indicated above. While the plant is growing in stature or bulk, cultivation that does not disturb the roots may aid it; but after tasseling begins, working in most cases delays the ripening. Some of the most successful farmers leave the plant to itself, when, after early and rapid tillage, it has reached the height of four or five feet, and so shades the ground as to choke down the weeds. Many cease at earing time, or when the corn is out of milk.

Special ways of cultivating corn. (*g*) *In gardens.* Gardeners try to make the most of their square rods. Very heavy manuring, and very deep tillage enable them to raise several crops in the same year off the same ground. Tomatoes ripen late from a comparatively early planting; let the plants, early grown from seed in boxes, be set out in properly prepared hills, six feet apart each way; and then let hills of sweet corn two and a half or three feet each way be planted among them, not too close to the tomatoes. The young tomatoes grow so slowly that the corn will, when properly manured and tilled, go on to the roasting ear state without being materially hindered in its growth; and is cut off just in time to give the tomatoes full scope.

(*h*) *Corn and potatoes* are sometimes grown in alternate rows with much advantage. Late potatoes require more shade than early ones, and sugar corn will not shade them any too much. Whether very tall corn will permit their full developement, is to be tested. It has been said that corn will grow in the same hill with potatoes, but records of results of such an experiment are not very abundant.

(*i.*) The habit of planting *beans and pumpkins* among corn

has come down from the Indians. The beans should be of late varieties planted at the last hoeing, so as not to interfere with tillage. Pumpkins, with the same precaution, may be planted in alternate rows in every third hill. Beans may be planted in the intervals in one direction, or at suitable distances apart, in circles round corn hills.

(*j*) The practice of listing was formerly resorted to in the West, where land was cheap and abundant, and time and money scarce and dear. One of the methods was to turn over shallow furrows at convenient distances apart; a man following the plow with an ax to cut through the slices at regular intervals and deposit the seed. The intermediate spaces could be plowed after the corn was up; much depended on the season as to the results; sometimes only five bushels were obtained, sometimes twenty-five.

(*k*) Maize culture in rainless Western districts, in connection with *irrigation*, has already been referred to; the general plowing being performed, irrigation is a substitute for after cultivation. According to the accounts given of this species of maize culture in New Mexico many years ago, the water was let in to mellow the earth, facilitate the plow, and bring the planted corn out of the ground. Furrows were then run three feet apart, to receive the seed, planted so close in the rows as scarcely to admit the hoe. One plowing and one hoeing from planting to maturity, were given the crop which received in the meantime from two to four irrigations, according to the weather, and the supply of water. There were large settlements along the smaller streams; each farmer took his turn in the use of water; the farmers were often restricted to a single irrigation during the summer, and sometimes a long drought caused a failure in this; but generally with the aid of chance showers fair crops were produced. The New Mexicans have found the necessity for irrigation diminished by deep plowing. The common shovel plow was then one of

their chief implements. Lands in those districts without running water had no agricultural value. The first watering was near the beginning of May. Deep furrows for planting were harrowed to prepare the surface for irrigation; the corn was shovel plowed till half leg high, and watered about 26th of June, and again when the sprigs began to loosen the ear. At Dona Ana, there were four or five irrigations on the crop; at Albuquerque the crop varied from thirty to fifty bushels, at other places from seventy-five to one hundred bushels per acre. At Fort Fillmore the land was rarely plowed even once after planting, and never more than in one direction, but there was great labor expended in irrigation. Farmers commenced gathering the maize by order of the Alcador all on the same day, and they gathered day and night.

Irrigation in the recent settlements of Colorado, as described in 1870, seemed to have made the maize crop more certain, though the average product was less. The main ditches being on highlands made irrigation each way easy, the lands being divided by small ditches. Corn was planted in rows and irrigated by streams of water let in between the rows; want of water was indicated by the curling up of the leaves at mid-day. Too much water in summer made vegetation turn yellow. After a wetting, the ground being dry enough to work, the cultivator was passed between the rows to prevent baking. Standing water with no outlet was ruinous to a crop, but a stream constantly flowing on a crop did no harm if it drained off immediately. On side hills exposed to washing, little troughs made by nailing four laths together were laid near the bottom of the ditches, a rod apart, for the water to run in.

Irrigation was not often required before the first or middle of June. Water moved more easily over the furrows of mucky soils, than those of light ones. Fall plowed lands required less irrigation than those plowed in spring. A citizen of Den-

ver favored leveling the land, and the use of machines for making the water run in little channels; he was for plowing deep, avoiding dead furrows, pulverizing the soil thoroughly, sowing pure good seed properly, running the ditches on a grade not more than half an inch to the rod, and from five to twenty rods apart, harrowing in the direction you would irrigate, rolling the young rooted grain, when the ground is moist, but not wet, at right angles to the head ditches; commencing irrigation before the crop begins to suffer from drought, and not quitting for a light rainfall.

An address before the Greeley Farmer's Club, stated that as good corn was grown there as any where, but the average was only twenty-five bushels to the acre; they could plant any time after the first of May; it would mature if planted by the twentieth; it could be put in and gathered when there was no other work, and after ripening might stand in the fields years without injury; it would not mature without water. From the San Antonio Valley in Texas, first settled by the Spaniards in 1718, where the soil is a rich deep black loam, it was stated that there was an irrigation once in ten days, the hours being fixed; every man had his dam and gate, and when his hour arrived lowered his gate, (his higher neighbor having finished irrigation and raised his gate); the water overflowed his land, while with the hoe he trenched here and dammed there, till all the ground was wet. Some skill was required to run the rows with reference to the ditch. Irrigable land in San Antonio Valley was worth $100 to $200 per acre; that with the same soil, but incapable of irrigation not $5. These Spaniards never manured.

The best time to irrigate is early in the morning, or about sunset. It is a good time when a rising cloud gives promise of a shower. It was stated in behalf of a Colorado colony, that they would not, if they could, have rain as it falls at the East, instead of irrigation; there being no uncertainty in a crop raised by the latter if properly conducted.

(*l*) The Navajoes, a powerful tribe of Indians, in West New Mexico, on the arid plains, drive stakes made of very hard wood, and made still harder by exposure to fire, twelve to eighteen inches into the soil, and thus form holes, each of which receives at the bottom a ball of mud, about the size of a man's fist, enveloping one or more grains of maize, the ball being covered with two or three inches of light earth, and the grains left to germinate. Sufficient moisture is thus contained to enable them to spring up; early evaporation is prevented by the thin covering of earth; the great depth of the hole shelters the roots from the heat and dryness of the superficial soil, and the plant is supported in its growth by the greater moisture of the subsoil. Good crops are the consequence.

CHAPTER XVIII.

CUTTING UP, HARVESTING, ETC.

(*a*.) One of the old methods was *topping*. It was believed that after the stamens at the top of the plant had fertilized the ear completely and become dry, the upper part of the stalk was of no further use. The top was then cut off with a sharp knife a little above the topmost ear, and the blades stripped as near as possible to the stem; the ears were left on the butt stalks to ripen.

Some of the advantages of this method were, an earlier saving of fodder as against frost; less exposure of the grain and fodder to mould from wet weather at harvesting or soon after; less weight and bulk of fodder to house, and perhaps in some cases greater certainty of the grain being moderately ripe. On the other hand, it was a slow operation; less fodder was saved, often it was not so well saved, and the corn was more liable to waste from shelling out when gathered.

If this crop was followed by wheat, it could not be so seasonably put in. The experience of many farmers was that nothing was gained either in the quantity or quality of ripe grain, and that in the ordinary course of farm business, less and inferior fodder was saved. Some, however, still prefer this method. When fodder is high and labor cheap, and the butts can be economized for cattle food, by being chopped fine and mixed with richer cattle feed, it may sometimes be most advantageous; so when the field is small as well as the working force, and the cultivator's circumstances or business do not admit of his keeping a horse, but only a cow or two, the time spent in topping and stripping is less of an object; while the comparative lightness of the fodder will enable him very promptly to put it under shelter by hand. He can turn the butts to good account as bedding for his cows or hogs.

(*b.*) Cutting up at the roots or near the ground has become the prevailing practice; it being very generally believed to be not only labor-saving, but better for both grain and fodder. If rightly shocked in moderately dry weather, the curing goes on very well, while the grain fills out from the accumulated riches of the stalk. The indications for the right time have been variously stated, as the drying up of the lower leaves, the partial whitening of the outer husks, the glazed appearance of the grain, and the finding no ears young enough for boiling. Cut up then, if you want the best fodder; some of the special times mentioned have been from 10th to 20th of September, and the 10th of October.

(*c.*) Instruments for cutting up were formerly made by breaking an old scythe in two or three pieces, and putting handles to them; the grass knife was sometimes used. A hand implement has been made expressly for the purpose, and also a rolling stalk cutter. Machines for cutting and shocking corn have been noticed, or have obtained premiums

at Ohio State Fairs at various times since 1853. Many have been patented in late years; one in 1873 is described as having disk cutters, one of which has a circumferential groove for the other to work in, for severing the stalks, which are conveyed and delivered in rear of the machine in quantities sufficient for shocking. One in 1874 cut the corn by a reciprocating cutter, and received it on the platform in a standing position, where it was gathered into a shock and removed by a derrick to the rear of the machine, where it was deposited on the ground.

(*d.*) By the old process of hand cutting, a certain number of hills are put together, around four central ones, with their tops tied diagonally so as to make a firm nucleus; if the weather at cutting is moist, a small number, say twelve or sixteen are put together at first, and after partial curing are gathered into larger ones, or removed to long rows resting against extended and supported poles, or to a well ventilated barn. A shock of twenty-five hills is one of the smallest spoken of for permanent field curing; under more favorable conditions from forty-eight to one hundred hills are put together, and in some cases where wheat is sown on corn ground, one hundred and twenty or one hundred and forty-four in shocks placed so as least to interfere with harrowing or plowing. The beauty of the harvest field is much increased by having these stand equi-distant, and it makes the wheat field much more regular, but for this purpose it will answer, if the rows of shocks are parallel in the direction in which the land is to be plowed or harrowed. If the corn is to stand in the field any length of time, its security against mould is greatly promoted by the proper construction of the shocks, built, if possible, against standing hills of equal stalks, and well tied below the top with flexible bands of corn or rye straw, so as to stand erect amid driving winds and rains. Machine cutting and shocking may perhaps answer very well

on level land, but it is not easy to see how the difficulty of getting firm shocks on steep side hills can be obviated by most of the machines heretofore patented.

(*e.* How long the shocks should remain in the field before husking and hauling in, must depend mainly on the convenience of the farmer; unless the dangers that beset the field as a depository of harvests are imperative as to its removal. One advantage of corn fodder as compared with hay, is the ease with which it is saved, so as to answer some good purpose as coarse feed. Those who keep cows, but have no barns, can usually stow away corn fodder in yards where there is room to plant a sufficient number of stout forks to receive the long riders on which the fodder may lean, or where a stack can be conveniently built. In either case, after being well cured, it can be better saved than in field shocks, unless after husking, several shocks, bound up in bundles for convenient handling, are well put together. Stock raisers frequently prefer to haul the corn and fodder husked or unhusked to the feeding lots, and spread on the grass for the animals to dispose of; and this sort of feeding often extends into the winter. Some farmers give one month to the shocks for curing, and then husk and haul in; others leave the corn in shock till the first or middle of October or November, or even December; some want a good frost on the shock before husking, as it dries the easier.

(*f.*) Husking was formerly done by hand, with some very simple contrivances as aids, and this was enlivened by husking bees which combined brisk work with sociality. Hand corn huskers of sundry patterns have been lately patented. By far the greater number of farmers, probably, still husk by hand, and generally in the field. Many are careful to leave the husks on the fodder. One of the corn husking gloves patented in 1873 is said to consist of metallic plates, provided with rows of teeth, used on the thumb, fore and little fingers

of the left hand, in connection with the common husking pin in the right hand. Quite a number of inventors of machine huskers have received patents—one of the briefest descriptions is this: "rolls tear the ear from the stalk, and the ear falls on outer rolls; the husk is torn from it on its descent." See page 412 Note.

(*g*) The Indian deposited his harvest under ground, because he seldom placed any permanent improvements above ground. The white man is a builder, and perhaps the simplest of his depositories for corn in the ear is the crib formed by putting fence rails with the ends crossing in a square, with a floor that will protect the grain from damp, and in some measure from vermin; and roofed with boards. Other cribs of the cheap kind are of logs unchinked. Some farmers spread the husked ears on the floors of their lofts. The improved crib is usually a building with a tight floor, resting on flat stones which rest on props high enough and so prepared as to make the climbing difficult for rats and mice; the whole width about four feet; the two long sides covered at parallel intervals by slats of equal width, say three inches, placed so as to air the corn; a suitable door being hung for putting in and taking out the ears. The height and length may be extended to meet the wants of the builder; but some farmers are careful to put only two hundred or three hundred bushels in one bulk. Where corn is fed largely to hogs or poultry, it is convenient to have the crib near the pens or coops. Corn cribs are not entirely unknown to the Patent Office. One patent describes an inclined floor and other improvements, and another a rectangular structure with deflectors, which cause the ears of corn to fall centrally through a narrow aperture to the floor beneath, so that an animal may reach in and withdraw an ear, but cannot eat it within the crib; many animals being thus permitted to feed from the same crib. See note on page 412.

(*h.*) There are so many conveniences about corn in the ear, that it is no wonder the price is sometimes higher than that of shelled corn. Its position is much more easily changed; it can be loaded ôn a car and dumped; it can be piled up in bulk on a railroad car or canal boat; the ear is convenient as a measure for feeding or small sales; its quality can be better estimated, and it keeps better in masses, especially on seaboard. If grinding is wanted, the corn and cob meal may be preferred for some animals, and if the cob is not ground, it makes excellent fuel. The main objection to it is its bulkiness; the weight is only one-fourth more than that of shelled corn; the latter is usually reckoned at fifty six lbs , the former at seventy pounds.

In 1850, (see U. S. P. O), fifty-six pounds was the standard weight of shelled corn in Vermont and Ohio, and the usual weight in Bristol Co. Mass., New Castle Co. Delaware, Buckingham and Amherst Cos. Virginia, and Iberville, Louisiana. Gourd seed corn in Delaware weighed from forty-nine to fifty two pounds, the more common kinds in Halifax Co. N. C. from fifty three to fifty-four lbs., the best variety, fifty-six lbs. Some estimates of the weight in Vermont and Pennsylvania were fifty-eight lbs , and in Massachusetts sixty lbs. Upland corn in Ohio over weighs that raised in the bottom. In 1853, in Vermillion Co Illinois, the season being good, the weight of a crop, fifty to sixty-five bushels to an acre, was estimated at from sixty to sixty-three lbs. per bushel; a crop of one hundred and thirty-six bushels to an acre in New Hampshire weighed seventy lbs. in the ear and fifty-nine lbs. shelled and dried. Another New Hampshire farmer found that on January 16, 1854, a bushel of shelled corn thoroughly dried weighed fifty-nine lbs., the result of shelling a bushel in the ear weighing sixty-eight lbs.

Shelling was formerly done in Southern Europe by scraping or rasping on a piece of iron; in Southern France the han-

dle of a frying pan was sometimes stretched across a tub and made fast at the ends by two notches. The operator scraped the ear lengthwise on the sharpest edge of the iron till the grain separated from the cob and fell into the tub, and a diligent man with strong wrists would shell from twenty to thirty bushels per day. A lot of husked ears in a sack might be thrashed out with a flail, and of unhusked ears sent through a thrashing machine by slightly modifying its arrangements. Loudon describes a shelling machine as composed of a vertical wheel covered with iron on one side, made rough by punctures; the wheel working in a trough and separating the grain by rubbing the ears thrown in by hand, one at a time, and while the separated grain passes through a funnel below, the naked cob is brought up at the end of the wheel opposite that at which it was put in. The wheel may be made rough either on both sides or on one side, according to the quantity of work to be done and the force to be applied.

In America corn has been beat out in barrels, and scraped off the edge of a spade or bayonet, but of late corn shellers in such abundance and variety have been introduced, that the shelling of corn often adds little or nothing to its value. Some of them clean as well as shell. See note on page 412.

(*i.*) From what has been said herein on the uses of maize, the importance to the farmer of good corn mills will be apparent. These are largely manufactured in the cities, and the prices range from $10 upward.

Grain was first pounded between two stones, afterwards broken between an immovable nether stone and an upper stone moved by hand,—the Hebrew and Greek mill, worked first by slaves and criminals and afterwards by asses. Water mills were used by the Romans. Buhrstone is the preferred material for modern mills, but sienite and granite are often worked into corn mills. The lower stone is fixed and is slightly convex; the upper one, somewhat concave, is sup-

ported by an axis passing through the lower one and revolving with considerable velocity; the distance between the two being adjustable for producing fine or coarse meal. The corn is shaken out of the hopper by projections from the revolving axis, which give to its lower part a vibrating motion. The corn entering at the middle of the stone, passes outward a short distance before it begins to be ground, and when powdered, its escape at the circumference is favored by the centrifugal force and the convexity of the lower stone. The surface of the stone is cut in grooves running obliquely to make it act more effectively on the corn. Iron mills have been extensively used of late. One advertised in Ohio Agl. Report for 1870, claims to have new features in the make of grinding plates. The teeth are all formed like the letter Y; the lower part of each tooth in its row connecting with the upper part next below, and so on through the whole series in each radiating row in the next circle. By this arrangement and shape of the teeth, the pulverized stuff in the mill is forced as well as ground towards the periphery or discharging edges, whether the motion is fast or slow. The mill grinds faster as the motion is increased.

(*j*.) The cost of cultivating corn varies mainly with value of land, price of applied manure, and labor of man and horses, or oxen, and interest on investments in cultivating and harvesting implements. The fairest way of reckoning it is by the acre, for the fodder, a very important item, is thus easily included. Where it is estimated by the bushel, the actual value of the fodder should be deducted from the total cost per acre. As the corn crop, when manured broadcast, generally leaves a portion not taken up, only part of its applied value ought to be charged to the corn. The cost of cultivation is probably greater in the East and other long settled districts than in the new lands of the West. In the East it costs nearly the same labor to get a small crop as a

large one. Among the various amounts given in by correspondents of the U. S P. O. in 1849-50, is that of forty-five cents per bushel for Indian Corn production, including interest on land, taxes, fencing, and all other charges, (Vermont); twenty-two cents for Atkinson, Maine, twenty cents for Jefferson Co, N. Y.; eighteen and one-half cents for New Castle Co., Delaware, forty cents, Amherst Co., Va.; nineteen and one-half cents, Wayne Co., Michigan; thirteen cents, including interest on land for a crop of forty-five bushels in Hillsdale Co, Mich; fourteen cents for Delaware Co., Ohio; ten cents for Newport, Indiana.

The estimate of the Shakers at Worcester, Mass., in U. S. P. O. 1853, (stiff clay, &c), was for plowing in September, four dollars; twenty five loads of compost, thirty dollars; cross plowing in spring, planting, and twice hoeing, seven dollars; in all forty-one dollars for one acre, crop thirty-five to fifty bushels, making from one dollar and seventeen cents to eighty-two cents per bushel. Compare this with the statement of Wm. J. Phelps of Peoria, Illinois, for same year. Preparing ground, one dollar, planting, twenty-five cents, cultivating, one dollar and a half, husking and cribbing, one dollar and twenty-five cents, in all four dollars for one acre; the usual crop of sixty bushels making the cost less than seven cents per bushel. In 1868, in Worcester Co, Mass., on one acre was spent twenty-seven dollars for manure, twenty-two dollars and fifty cents for other cost; the product being one hundred and eleven and one-half bushels, made forty four and one third cents per bushel; three tons of stover should be deducted from the cost per acre. In the same year a crop in Auglaize Co., Ohio, on one acre was eighty-one bushels, six lbs, the cost being eight dollars, less than ten cents per bushel.

An account from one of the old slave States (Delaware, 1849,) makes plowing one dollar; harrowing, twenty cents;

seed, eight cents; marking, fifteen cents; husking, one dollar twelve and one half cents; shelling, fifty cents; hauling, one dollar; interest on land, four dollars and eighty cents; checkering, fifteen cents; planting, nineteen and one-half cents; working, one dollar and twenty cents; cutting, thirty-seven and one-half cents; in all, ten dollars and seventy-seven and one-half cents; deducting fodder, one dollar and a half, leaves nine dollars, twenty-seven and one-half cents per acre, or eighteen and one half cents per bushel.

In 1871, (see U. S. A. R.), crops were raised at Knightstown, Ind., costing twenty and three-fifths cents; at North Fairfield, Ohio, twenty-two and one-third cents, by J. C. Burroughs of Illinois, twenty-seven cents; at Chester Co. Pa , twenty-five and one half cents; at Oneida Lake, N. Y., forty-five cents per bushel.

(*k.*) The shrinkage of corn has been referred to under the head of varieties. Experienced farmers in Southern Ohio say corn loses in weight or measure considerably by being kept till spring. Four lbs. from fall to spring is the better estimate; that is, ear corn in the fall weighs seventy-two lbs , in the spring, sixty-eight One makes it seventy lbs before first of February, sixty-eight lbs. after. Some weight is lost from worm eating as well as shrinkage.

(*l*) For *soiling* and fodder, corn is sometimes sown broadcast, two or three bushels to an acre, but as this may result in too much shade, the following method practiced a few years ago on soil in good heart near a barn, well plowed and harrowed and sown from large southern varieties, with good results, may be safely recommended:

Batchelder's corn planter was set to drop hills one foot apart; the machine was then run backwards and forwards as near rows already planted as possible, without actually interfering with them; the planted field was then well rolled. The corn came up finely. On sixth of August, an average stalk was

cut from one of the rows where the tassel was just in sight and found to weigh three and a half lbs., subsequently cured it weighed one lb. If there was one such stalk on each foot there would be seventy-six tons (of 2,000 lbs. each,) to acre of green stalks. Probably ten tons to the acre of dry fodder could be obtained from land so conditioned.

Mr. Temple Cutler of Massachusetts, (U. S. P. O. 1849-50) stated that the corn might be sown in drills or broadcast, so as always to have a crop in the proper stage for soiling cattle.

Mr. Waring, an eastern agriculturist, is quoted in U. S. A. R. 1871, as recommending the sowing of corn for fodder in drills three feet apart, so that they may be worked with a cultivator.

Mr. L. S. Abbott, of Painesville, Ohio, in U. S. A. R. 1866, prefers the broadcast sowing as giving the greatest yield. He objects to the drill sowing, worked by the cultivator, as making the stalks too coarse to be entirely eaten up by the stock. Their coarseness depends somewhat on how thick the sowing is in the drills, and how tall the natural growth of the variety chosen; and if, as some writers assert, the nutriment is richer in stalks, the lower parts of which have a better exposure to the sun, the cattle will probably contrive to masticate them. But in this they may be assisted by fodder cutters, provided for the purpose, the pieces for obvious reasons being cut not less than two inches long. Mr. Abbott gives as the possible product, ten tons per acre as the estimate of good judges, and in quality, very much better than hay, and relished by all kinds of stock. As it is generally sown to supply the deficiency of the grass crop late in the summer, its necessity for this purpose can be determined before the first of June, which is early enough for sowing the corn. He thinks it may be sown much later with good results, and that sown even in mid-August, during the summer drought, the corn will tassel before the autumnal frosts, in the latitude of

Northern Ohio. He would sow three and a half bushels to the acre. The difficulty about the time of sowing is in curing the fodder late in the fall, when the long, cold rains so often stand in the way of proper harvesting; the abundance of saccharine matter in the stalks requiring several consecutive days of good drying weather. If the farmer's chief reliance for fodder is on sowed corn, he should sow in good season, so that there may be no "weather contingency at curing time." "When the corn is stout, the burden on the ground is very large, and when the season has been attended with heavy wind storms, the corn will be twirled and twisted round and sometimes badly; just in proportion to this will the cutting be laborious." For doing this work promptly, a cradle with short strong fingers has been made; for binding it needs five or six days of warm bright weather to wilt it sufficiently; small bundles are best, put up in shocks of medium size, tied at top.

Some farmers after thorough wilting, stack it in alternate layers with straw. A foundation high enough for proper airing beneath, is made by crossing timbers, the material is then stacked round a box drawn up as the stack is elevated. Horses fed on this kind of fodder never have the heaves, and cattle foddered with it mixed with some sweet turnips, have a sleek and bright appearance. In the far South this kind of fodder should be the main dependence of the farmer for feeding his stock; the genial autumns, long drawn out, being eminently favorable to the curing process. Texas grows corn very much better than the grass suited for haymaking; the special fodder crop is, of course, very desirable there.

A farmer in Ontario Co. New York, (see U. S. A. R. 1869), on a field duly prepared, sowed oats broadcast, the usual amount, and afterwards drilled in corn, in the proportion of three bushels of corn to one of oats. They grew very evenly together. Some installments were cut for immediate

use for the general harvesting, but when the oats were ripe, the crop was cut like grass. The dry oatstraw then absorbed the moisture of the cornstalks; the whole was easily cured. Horses and cattle ate it greedily.

An extended article on the green soiling of stock, including the culture of corn fodder, by D. S. Curtis, of Madison, Wisconsin, will be found in U. S. P. O., 1859.

(*m*) In conclusion, among the many things important to be considered by the young maize grower, who desires permanent success, it may be well to allude especially to three:

1st. The relation of maize growing to the culture of other crops, even when the operations are conducted on the most limited scale. It will be found that a reasonable attention to other cultures will make the success of the year's crop more certain. A good grass field especially, is one of the best preparations for the maize crop. Nature has already provided this on the prairies; the best grass sod on soil fresh from timber is made by judicious pasturage. The season may favor the maize crop one year, and be adverse another year, when some other crop is favored. Insects or other enemies may prove ruinous to the most carefully cultivated maize field, and leave some other growths uninjured.

2d. While it is important to aim at producing the fullest crops, it is far better to manage so as to make them better and better from year to year, than to begin with largest crops and run down to small ones. The young corn grower whose prudence leads him to choose methods suited to his circumstances and location, which give the most certain promise of a fair crop, will be most apt to go on improving. If he has too high expectations of first results, the chances are that he may be disappointed, and lose the stimulus given by a first success.

3d. Keeping out of debt has been proved by the experience of late years to be one of the best helps to permanent

success in this as well as other cultures. Strong and durable fences rather than showy ones, buildings that will last and that will secure the crops of the farm and accommodate its occupants, and at the same time please by a reasonable share of architectural beauty; domestic animals of good breed that can be well fed; implements whose use is well understood, sufficient for the most thorough culture, and good land, but not more of it than can be well tilled, and not enough of it to involve the purchaser in hopeless or embarrassing debt—in short, all things in proportion—with good habits, patriotic motives and unselfish aims, are among the best guarantees of good times a coming.

Broom Corn.

As the culture of Broom Corn has some similarity to that of maize, a few statements in regard to it from the U.S. P. O., and U. S. A. Reports are subjoined:

U. S. P. O. 1854. E. Smith of Sunderland, Franklin Co. Mass. states that in the previous fall and winter he drew to a lot twenty cords of muck, mixed with five and one-half cords of sheep manure; in April the whole was turned over and mixed, and eighteen bushels of ashes added. About May 1st, it was turned over a second time, and on the 15th of May harrowed in, and planted with Woodward's corn planter, and one hundred lbs. of superphosphate of lime put in the hills. The land was cultivated and hoed four times, and there was taken from it by estimation, eight hundred lbs. of brush to the acre. Broom Corn had been grown on the land the two previous years. Crop raised on an acre and nine rods, of brush, 1,025 lbs., and seed, sixty-seven bushels, weighing forty lbs. to the bushel.

Value of 1,025 lbs. brush at 10 cts.		$102 50
Value of sixty-seven bushels of seed,		26 80
		$129 30
Expense of plowing, harrowing and planting,	$2 50	
Manure,	12 00	
Hoeing,	7 00	
Harrowing, scraping, and cleaning seed,	10 00	
Interest on Land,	7 00	38 50
Net Profits,		$90 80

S. G. Hamlin, West Glenville, Schenectady Co. N. Y. The chief objection to growing on upland is, that it makes no fodder or manure, except the stalks, which are of little importance either as a fertilizer or feed. They are generally consumed in the field after the brush is taken off. The usual method of cultivation is to plow the land in spring, harrow

till the soil is pulverized and mellow, and then roll down smooth with revolving plank or log roller. The seed is sown in the spring as early as the condition of the ground will admit, in rows about three feet apart, and six to eight inches in the drills. Soon as the corn is above ground, a narrow space of land on each side of the rows is scraped with a hoe to prevent the weeds from hindering its growth; the remaining space is left for the cultivator, which is frequently run to keep down weeds. The cultivation is usually finished by running the plow twice to each row. The brush is cut while green, and as often as convenient. As it grows from eight to twelve feet high, the tops are first bent or lopped to one side and cut with seven or eight inches of stalk left on; each stalk composes a brush.

M. F. Meyer, of Kingston, Luzerne Co. Pa., states that broom corn was raised on river flats and was a profitable crop. The average yield of seed was fifty bushels to the acre, worth fifty cents per bushel. He had known eighty-five dollars an acre to be paid for the crop before harvesting.

U. S. A. R. 1868, reviewing the State Reports of Missouri Agriculture, states that the bottom lands of Missouri are suited to its growth. Land producing a rapid and tall growth of Indian Corn, will grow good broom corn. A growth of head of from twelve to eighteen inches is the most profitable crop for manufacturers; yet for "hurl," or those brooms made from the brush, without using any of the stalk under the wire, which are the most desirable brooms, a growth of twenty to twenty-four inches is necessary. An average crop is about one-fourth of a ton per acre, worth about one hundred and fifty dollars per ton. The seed is almost equal to oats for all kinds of stock, averaging forty bushels to the acre, worth thirty dollars; total product of the acre, $67 50; labor not more than required for an acre of Indian Corn. The price of brush depends on supply and demand.

LIV.

Bushels in Maize crop of U. S. for 1875; Average yield per acre; No. of acres planted; Average price per bushel and total value. No. of Swine Jan'y 1876, average price and value of same.

(From United States Agricultural Report, 1875.)

STATES.	Corn Bushels.	Yield Av. Bush	Acres.	Av. Price.	Value.	No. Swine.	Av. Price	Value.
Maine	1,300,000	30.5	42,622	$0 96	$1,248,000	58,800	$11 66	$685,608
New Hampshire	1,650,000	38	43,421	94	1,551,000	37,300	16 20	604,260
Vermont	1,720,000	37	46,486	94	1,616,800	51,800	12 19	631,442
Massachusetts	1,620,000	37	43,783	95	1,539,000	75,600	18 03	1,363,068
Rhode Island	290,000	27.5	10,545	1 10	319,000	16,300	17 05	277,915
Connecticut	1,775,000	29	61,206	1 00	1,775,000	57,900	16 73	968,667
New York	19,750,000	34	580,882	74	14,615,000	568,700	11 39	6,477,493
New Jersey	9,600,000	41	234,146	65	6,240,000	153,000	13 83	2,115,990
Pennsylvania	44,000,000	40	1,100,000	58	25,520,000	875,000	11 50	10,062,500
Delaware	3,267,000	26	125,653	57	1,862,190	46,700	10 61	495,487
Maryland	14,200,000	30	473,333	55	7,810,000	233,500	7 10	1,657,850
Virginia	21,333,000	22	969,681	54	11,519,820	589,800	4 45	2,624,610
North Carolina	22,275,000	15	1,485,000	60	13,365,000	758,300	4 01	3,040,783
South Carolina	9,240,000	10.2	905,882	1 00	9,240,000	275,900	4 11	1,133,949
Georgia	20,100,000	10	2,010,000	86	17,286,000	1,360,700	3 91	5,320,337
Florida	2,150,000	10	215,000	1 08	2,322,000	175,400	2 26	396,404
Alabama	24,500,000	12.6	1,944,444	75	18,375,000	755,900	3 99	3,016,041
Mississippi	23,220,000	18	1,290,000	72	16,718,400	792,900	4 31	3,417,399
Louisiana	7,920,000	15.5	510,967	89	7,048,800	222,600	3 98	885,918
Texas	31,000,000	20	1,550,000	83	25,730,000	1,090,000	4 09	4,458,100
Arkansas	19,448,000	30	648,266	52	10,112,960	901,200	3 31	3,523,692
Tennessee	58,000,000	26.5	2,188,679	41	23,780,000	1,026,400	5 22	5,357,808
West Virginia	10,560,000	29.1	362,886	56	5,913,600	248,400	5 38	1,336,392
Kentucky	60,200,000	33.3	1,807,807	41	24,682,000	1,604,300	5 51	8,839,693
Ohio	95,000,000	34.5	2,753,623	44	41,800,000	1,596,100	8 06	12,864,566
Michigan	23,600,000	33	715,151	61	14,396,000	459,700	7 93	3,645,421
Indiana	95,000,000	34	2,794,117	39	37,050,000	2,136,000	7 70	16,447,200
Illinois	280,000,000	34.3	8,163,265	34	95,200,000	2,640,100	8 63	22,784,063
Wisconsin	15,200,000	21	723,809	54	8,208,000	540,700	7 58	4,098,506
Minnesota	7,340,000	29.2	251,369	42	3,082,800	213,400	6 99	1,491,666
Iowa	160,000,000	35	4,571,428	27	43,200,000	3,296,200	8 08	26,633,296
Missouri	128,000,000	36.6	3,497,267	28	35,840,000	1,874,300	5 94	11,133,342
Kansas	76,700,000	40	1,917,500	23	17,641,000	246,500	8 91	2,196,315
Nebraska	28,000,000	40	700,000	20	5,600,000	80,900	7 58	613,222
California	1,500,000	36.3	41,322	1 07	1,605,000	363,300	7 17	2,604,861
Oregon	96,000	26.5	3,622	91	87,360	181,500	4 41	800,415
Nevada	15,000	29	517	1 08	16,200	5,200	9 00	46,800
Territories	1,500,000	26	57,692	1 02	1,530,000	116,500	8 75	1,019,375
Totals	1,321,069,000	29.4	44,841,371	$ 42	$555,445,930	25,726,800	$6 80	$175,070,484

(From United States Agricultural Report, 1875.)

Movements of Indian Corn (bushels,) in the principal Cities of United States for the years:

CITIES.	1873.		1874.		1875.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	24,576,345	15,416,787	29,329,000	26,447,807	22,488,707	12,955,525
Boston	3,558,363	162,729	3,303,641	380,254	5,346,340	1,551,776
Philadelphia	8,233,400	2,202,368	5,954,700	....	5,950,800	4,601,586
Baltimore	8,330,449	6,003,618	9,355,467	5,959,757	9,567,141	6,980,802
Cincinnati	2,259,544	324,183	3,457,164	658,718	3,695,561	595,915
Chicago	38,157,232	36,754,943	35,799,638	32,705,224	28,341,150	26,443,884
Milwaukee	921,391	197,920	1,313,642	556,563	949,605	226,985
St. Louis	7,701,187	5,260,916	6,991,677	4,148,556	6,710,263	3,523,974

Hogs packed during the four last winter packing seasons at six leading points in the West, compared with the whole. U. S. A. R. 1875, & Cin'ti Gazette.

CITIES.	1872-73.	1873-74.	1874-75.	1875-76.
Chicago........	1,425,079	1,520,204	1,690,348	1,592,065
Cincinnati.....	626,305	581,253	560,164	563,359
St. Louis.......	538,000	463,793	462,246	329,895
Indianapolis.	196,317	295,766	278,339	323.184
Milwaukee ...	303,500	294,054	236,596	181,972
Louisville.....	302,246	226,947	273,118	223,147
Total 6 Cities,	3,391,447	3,382,017	3,500,811	3,213,622
Other Points,	2,008,947	2,084,183	2,065,415	1,666,513
Grand Total..	5,400,394	5,466,200	5,566,226	4,880,135
Pr. ct. 6 Cities	62.68	61.87	62.89	65.81
Sum'r Pack'd	....	....	1,200,404	1,262,343
Win'r Pack'd	....	....	5,566,226	4,880,135

Amount of regular packing in the seaboard Cities is so small, that no attempt has been made in those cities to collect regular statistics. The facilities afforded in the East are not such as to enable packers to compete with the West.

Ohio Statistics, 1877.

No. of Hogs packed for the two winter seasons following in Ohio.

CITIES.	1875-76.	1876-77.
Circleville	15,339	15,942
Cleveland	88,077	121,202
Cincinnati.......	563,359	523,576
Dayton......	5,000	5,000
Kenton............	5,200	5,300
Lima	5,339	7,062
Minster............	7,300	6,200
New Bremen...	7,250	7,125
New Vienna....	....	5,500
Piqua...............	6,000	5,000
Ripley	6,000	5,500
Toledo.............	4,317	12,369
Wash'ton C. H.	20,165	15,000
Wilmington.....	15,600	7,000
Xenia..............	17,582	16,000
All other points	56,407	55,933
Total	822,935	813,709

Total number of Hogs cut in Cincinnati, each winter packing season for the following years. [See Ohio Statistics for 1873, 1877, U. S. A. R. 1875, &c.]

Years.	No.	Years.	No.	Years.	No.	Years.	No.
1832-33......	85,000	1842-43......	250,000	1852-53......	361,000	1862-63......	608,457
1833-34	123,000	1843-44......	240,000	1853-54......	421,000	1863-64......	370,623
1834-35......	162,000	1844-45......	196,000	1854-55......	355,786	1864-65	350,600
1835-36......	123,000	1845-46......	205,000	1855-56......	405,396	1865-66......	354,079
1836-37......	103,000	1846-47......	250.000	1856-57......	344,512	1866-67......	462,610
1837-38......	182,000	1847-48......	475,000	1857-58......	446,677	1867-68......	366,831
1838-39......	90,000	1848-49......	410,000	1858-59......	382,826	1868-69......	356,555
1839-40......	95,000	1849-50......	393,000	1859-60......	434,499	1869-70......	337,330
1840-41......	160,000	1850-51......	334,000	1860-61......	433,799	1870-71.....	481,560
1841-42......	220,000	1851-52......	352,000	1861-62	474,467	1871-72......	630,301

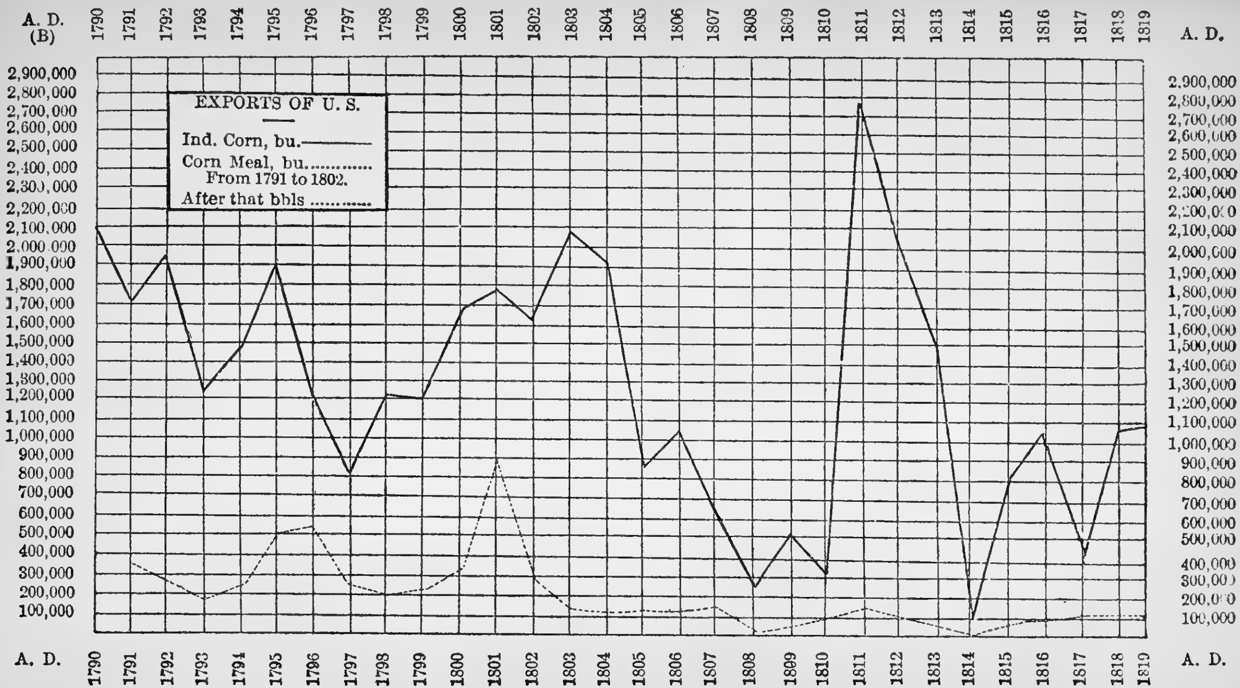
The Ohio Statistics for 1876 *give the winter packing for* 1875-76, *at points not mentioned above, packing ten thousand or over.*

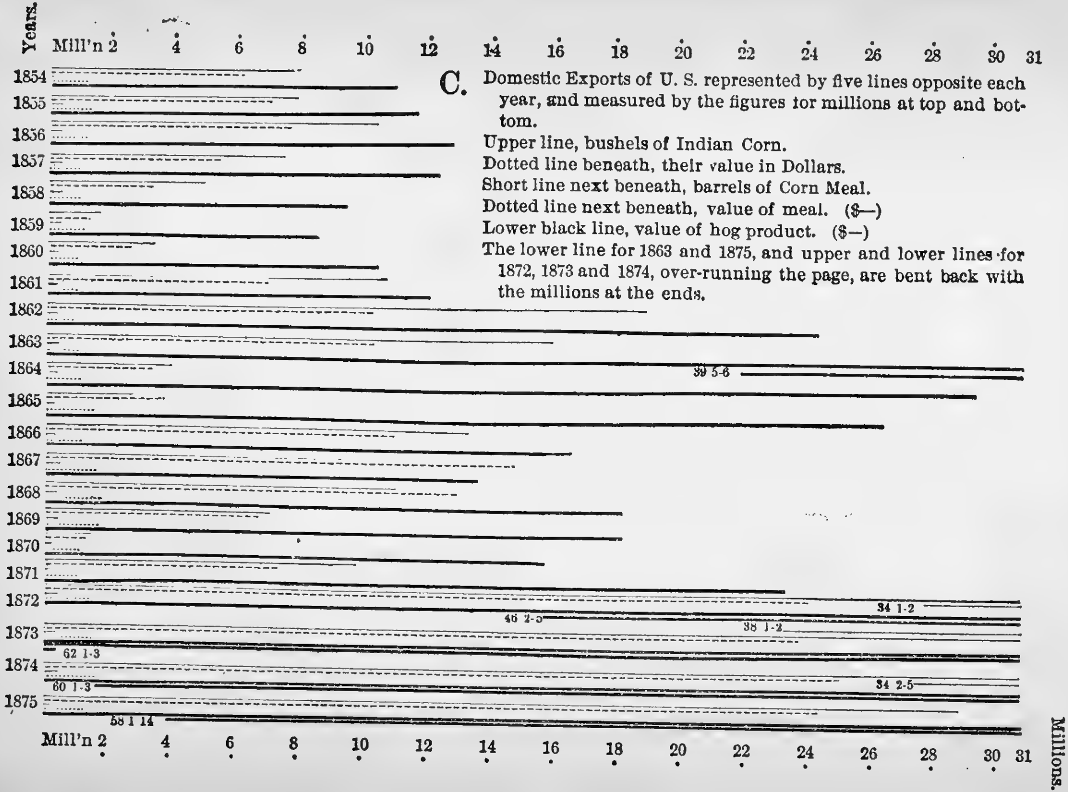
CITIES.	No.	CITIES.	No.	CITIES.	No.
Peoria, Ills.............	87,991	Council Bluffs, Ia	26,410	Franklin Ind......	12,678
St. Joseph Mo. & vicinity...... } ...	84,390	Galena, Ills........	25,000	Greensburg, Ind.	12,394
		Richmond, Ind...	22,700	Pekin, Ills..........	12,000
Cedar Rapids, Iowa.	75,968	Omaha, Neb......	18,025	Washington, Mo	12,000
Kansas City, Mo.....	74,500	Madison, Ind......	16,046	New Castle, Ind.	11,734
Quincy, Ills............	52,239	St. Paul, Minn....	16,000	Hagerstown, Ind	11,400
Dubuque, Iowa......	50,542	Barry, Ills...........	15,300	Evansville, Ind..	11,000
Des Moines, Iowa...	40,068	Gosport, Ind.......	15,000	Burlington, Iowa	10,665
Detroit, Mich..........	32 410	Canton, Mo.........	14,000	Davenport, Iowa	10,572
Sabula, Iowa...........	32,355	Terre Haute, Ind	13,200	Bowl'g Green, Ky	10,320
Keokuk, Iowa......	29,750	Springfield, Ills...	12,544	Leavenworth, Ks	10,033
Ottumwa, Iowa.......	27,633				

I.—Estimated crops in bushels. II.—Acres cropped. III.—Value $——, in 1868. U. S. Agricultural Report.

(A)

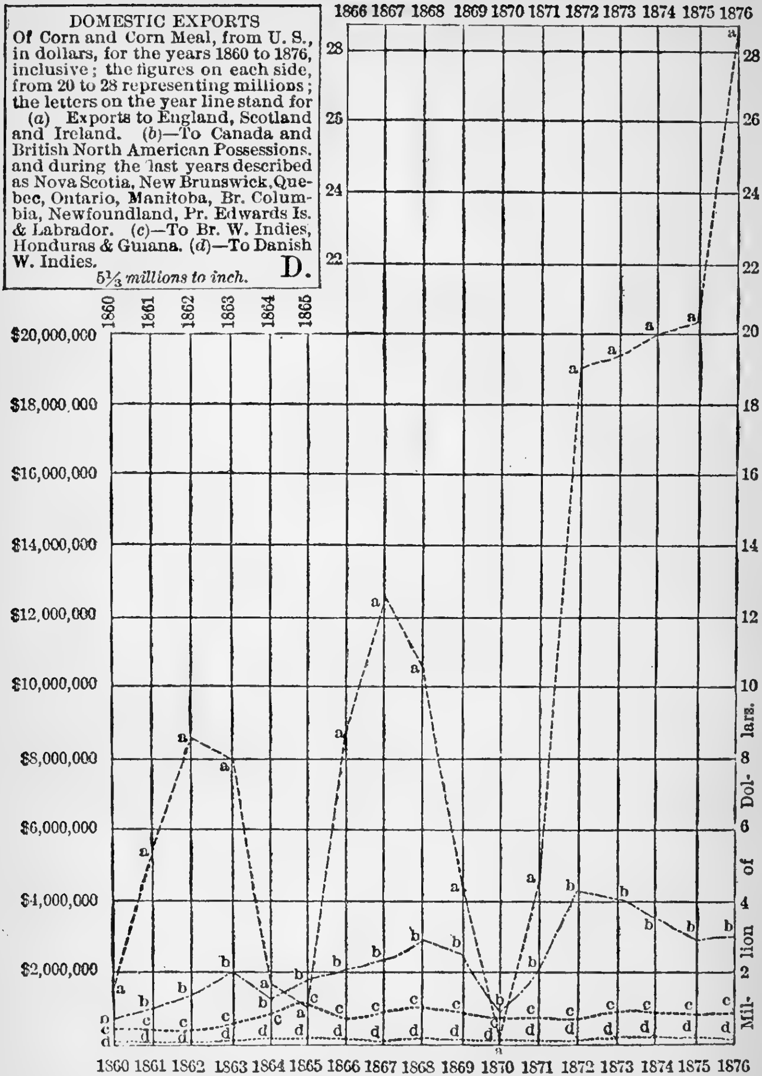
I.	Maize, 906,527,000 bushels.	Wheat, 224.036.600	Oats, 254.960.800	Potatoes, 106.090.000	Rye, 22,504.800	Barley, 22.896.100	Buckwheat, 19.863.700
II.	Maize, 34,887,246 acres.	Wheat, 18,460,132	Oats, 9,665,736	Rye, 1,651,321	Potatoes, 1,131,552	Buckwheat, 1,113,993	Barley, 937,498
III.	Maize, $569,512,460.	Wheat, $319,195,290.	Oats, $142,484,910.	Potatoes, $84,150,040,	Barley, $29,809 931.	Rye, $28,683,677.	Buckwheat, $20,814,315.


A. D.
(B)
EXPORTS OF U. S.
Ind. Corn, bu.
Corn Meal, bu.
From 1791 to 1802.
After that bbls



C. Domestic Exports of U. S. represented by five lines opposite each year, and measured by the figures for millions at top and bottom.

Upper line, bushels of Indian Corn.
Dotted line beneath, their value in Dollars.
Short line next beneath, barrels of Corn Meal.
Dotted line next beneath, value of meal. ($—)
Lower black line, value of hog product. ($—)
The lower line for 1863 and 1875, and upper and lower lines for 1872, 1873 and 1874, over-running the page, are bent back with the millions at the ends.


DOMESTIC EXPORTS
Of Corn and Corn Meal, from U. S., in dollars, for the years 1860 to 1876, inclusive; the figures on each side, from 20 to 28 representing millions; the letters on the year line stand for (a) Exports to England, Scotland and Ireland. (b)—To Canada and British North American Possessions, and during the last years described as Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Br. Columbia, Newfoundland, Pr. Edwards Is. & Labrador. (c)—To Br. W. Indies, Honduras & Guiana. (d)—To Danish W. Indies.
5⅓ millions to inch.
D.
1860 1861 1862 1863 1864 1865 1866 1867 1868 1869 1870 1871 1872 1873 1874 1875 1876
$20,000,000
$18,000,000
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
28
26
24
22
20
18
16
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2
Mil- lion of Dol- lars.

TABLES.

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ADDENDA.

From the Report of the U. S. Com'r of Agriculture, in the Cincinnati Star of October 19, 1878, it appears that the October ('78), average condition of the corn crop was 96., and the indications favored a crop of 1,300 million bushels of corn, and 400 million bushels of wheat. The final estimate is not made till after returns have been tabulated.

The number of swine in the United States as estimated by the Agricultural Department in January, 1874, was 30,860,900, at an average value of $4.36, amounting to $134,565,526; in January, 1875, the number was 28,062,200, at average value of $5.34, amounting to $149,869,234. In both these years, and in 1876, Iowa had the greatest number and the largest value, Illinois being next; the smallest number was in Nevada. The lowest price in '74 was in Oregon; in '75 was in Arkansas; in '76 was in Florida. The highest prices in New England.

In the returns of seven Western State Auditors for 1877, as mentioned in the Financial Chronicle, Iowa hogs under six months were excluded, and Illinois had the largest number, 2,961,366; Indiana next, 2,455,534; then Missouri, 2,341,222 and Ohio, 2,139,910. The Financial Chronicle for 1877 shows that Breadstuffs, including Rice, exported from U. S. in year ending June 30, 1875, were valued at $111,478,096; meats, $39,217,176; lard, $22,900,522. In year ending June 30, 1876, breadstuffs, &c., exported $131,212,473; meats, 49,592,834; lard, $22,429,485. In year ending June 30, 1877, breadstuffs, $117,884,588; meats, $67,288,758; lard, $25,562,665.

The summer hog packing in the West from March 1, in the years 1876, 1877.

Cities.	1876.	1877.
At Chicago to September 15	885,000	1,095,000
At Cincinnati, " "	82,500	110,500
At Indianapolis, " "	195,000	156,000
At St. Louis, " "	100,000	110,000
At Cedar Rapids, " "	72,800	91,000
At Kansas City, " "	12,630	63,000
At Cleveland, to August 25	123,571	103,864
At other points approximately	68,499	145,636

The estimated value of imports of Indian Corn into the United Kingdom of Great Britain from September 1 to August 31, in the years 1874-5, was £7,095,489; in 1875-6, £11,443,417; in 1876-7, £10,648,150.

———o———

The following list contains some of the earliest subscribers to this work, together with the places of residence, &c.:

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